United States Department of Agriculture

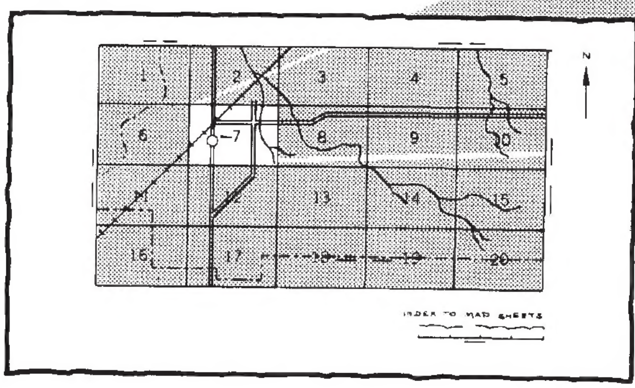
Soil Conservation Service

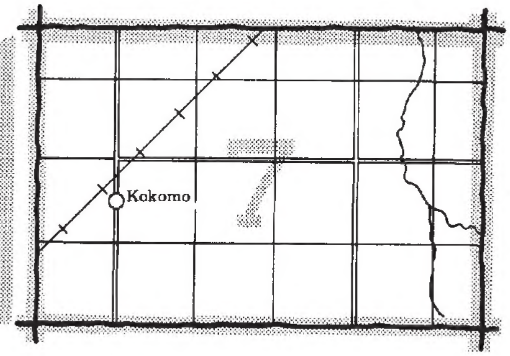
In cooperation with Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University

Soil Survey of Van Buren County, Michigan

HOW TO USE

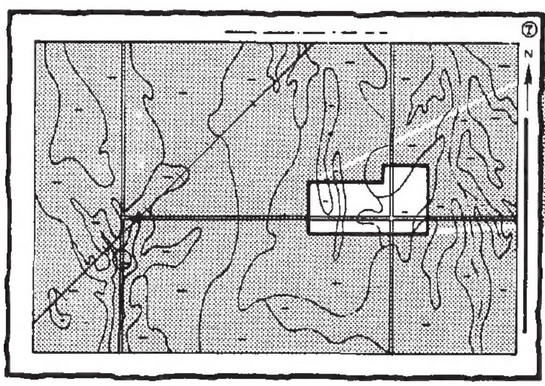
1. Locate your area of interest on the "Index to Map Sheets."

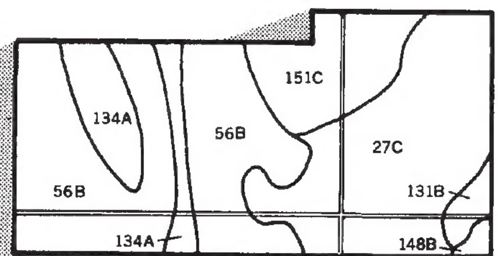




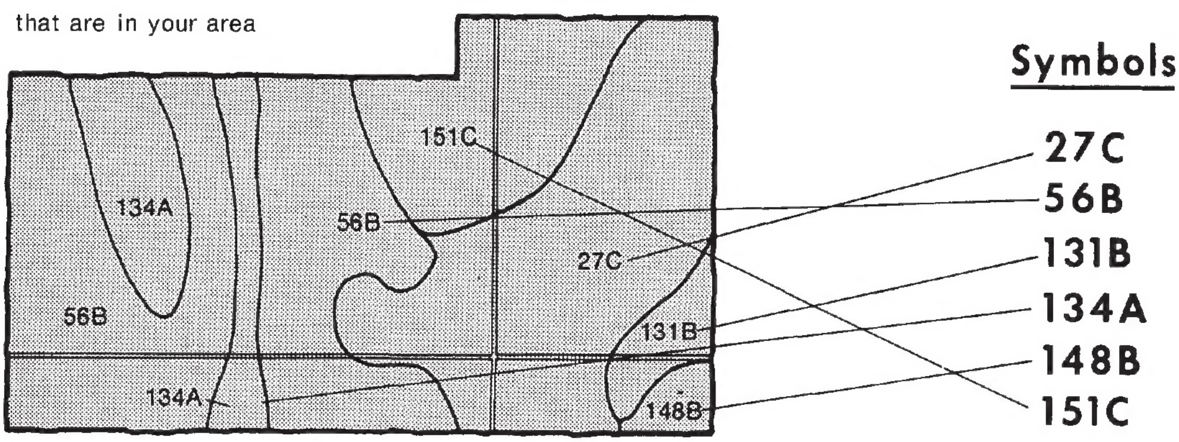
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



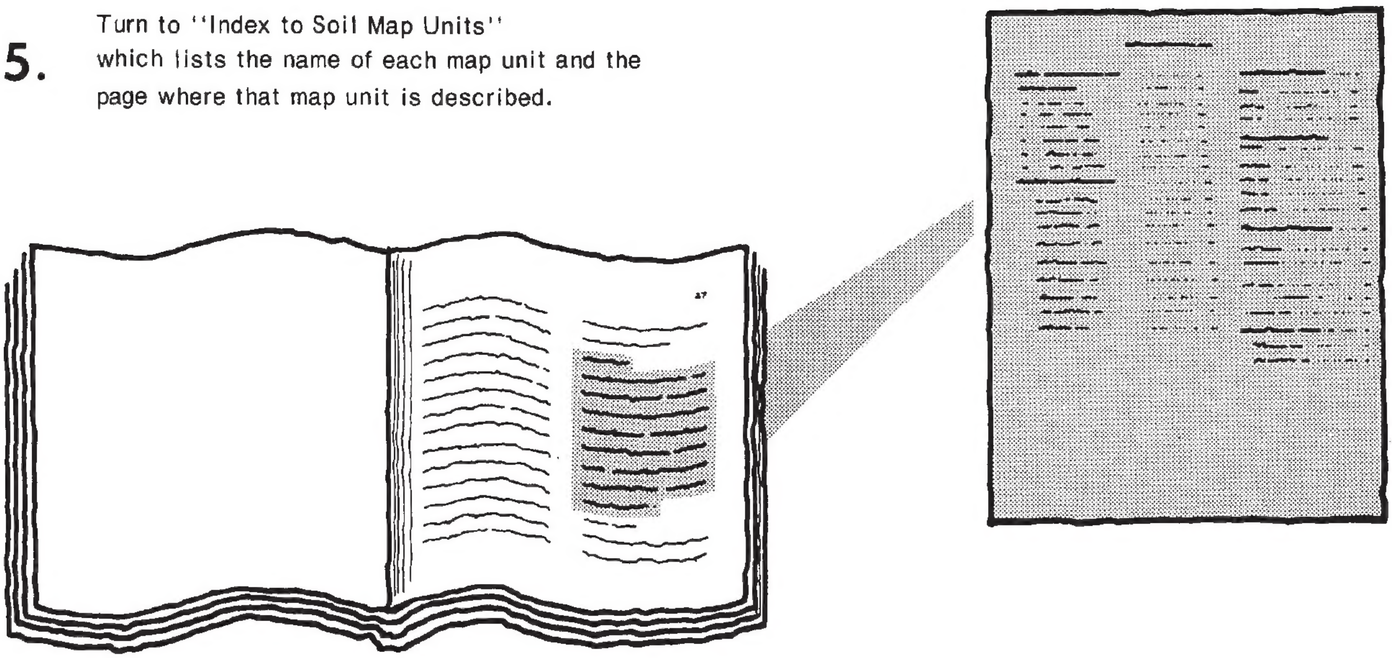


4. List the map unit symbols that are in your area

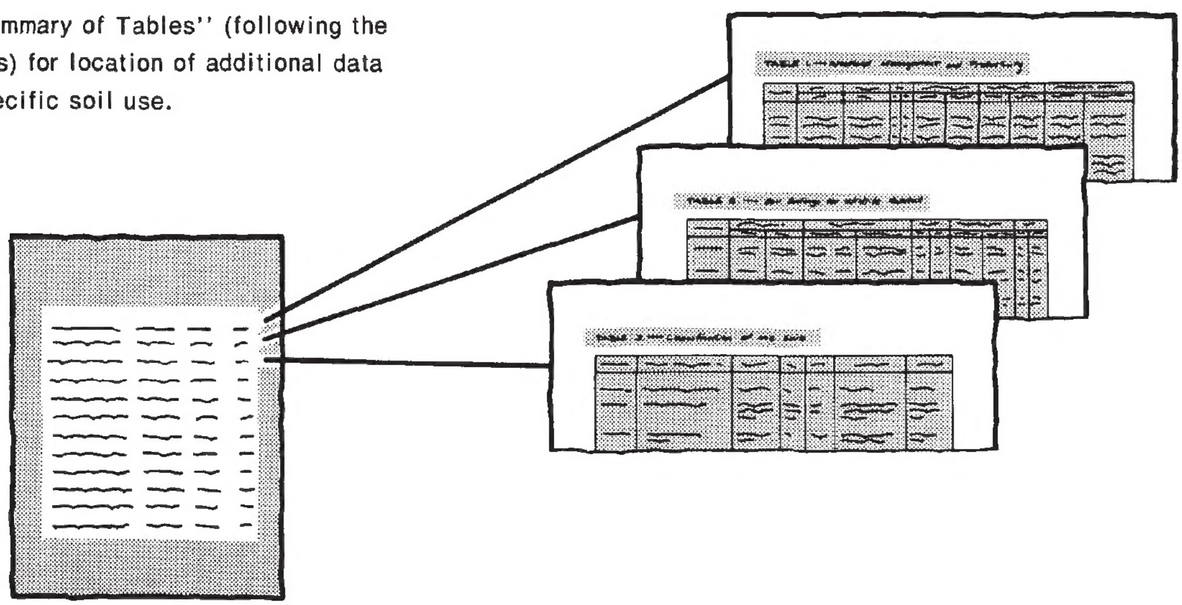


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service, the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, and Michigan Technological University. It is part of the technical assistance furnished to the Van Buren County Soil Conservation District and the Alle-Van Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Vineyards in an area of the Coloma-Spinks-Oshtemo association. Van Buren County had the second largest acreage of grapes in the state in 1981.

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Soil Series

Issued September 1986

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Van Buren County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Homer R Hilner

Homer R. Hilner
State Conservationist
Soil Conservation Service

Location of Van Buren County in Michigan.

Soil Survey of Van Buren County, Michigan

By William L. Bowman, Soil Conservation Service

Fieldwork by Franklin R. Austin, William L. Bowman, Robert E. Evon, Bruce D. Knapp, Jerry D. Larson, and Richard W. Neilson, Soil Conservation Service; Terri M. Smith, Michigan Department of Agriculture; and William B. Hogan and Helen J. Kredo, Van Buren County

United States Department of Agriculture, Soil Conservation Service, in cooperation with Michigan Department of Agriculture, Michigan Agricultural Experiment Station, and Michigan Technological University

VAN BUREN COUNTY is in the southwestern part of the Lower Peninsula of Michigan. It is bounded by Allegan County to the north, Kalamazoo County to the east, Cass County to the south, and Berrien County and Lake Michigan to the west. It has a land area of 391,296 acres, or 621 square miles.

This survey updates the soil survey of Van Buren County published in 1926 (*14*). It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about Van Buren County. It describes climate, history and development, land uses, geology, relief, drainage, native vegetation, and agriculture.

Climate

Prepared by the Michigan Department of Agriculture, Climatology Division, East Lansing, Michigan.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bloomingdale in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season. The data in tables 2 and 3 are for the period 1930 to 1979.

In winter the average temperature is 25.5 degrees F, and the average daily minimum temperature is 17.8 degrees. The lowest temperature on record, which occurred at Bloomingdale on February 10, 1912, February 5, 1918, and February 7, 1978, is -22 degrees. In summer the average temperature is 69.1 degrees, and the average daily maximum temperature is 81.1 degrees. The highest recorded temperature, which occurred at Bloomingdale on July 5, 1911, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 38.28 inches. Of this, 21.31 inches, or about 56 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17.3 inches. The heaviest 1-day rainfall on record was 9.78 inches at Bloomingdale on September 1, 1914. This is the greatest 24-hour precipitation total ever recorded in the history of Michigan climatological observations. The 9.78 inches fell in only 6 hours. Thunderstorms occur on about 36 days each year.

The average seasonal snowfall is 91.4 inches. The greatest snow depth at any one time during the period of

record was 45 inches, on December 12, 1962. On the average, 64 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. The highest seasonal snowfall was 158.8 inches, during the winter of 1962-1963. The lowest seasonal snowfall was 21.2 inches, during the winter of 1905-1906. The heaviest 1-day snowfall on record was 20 inches, on December 10, 1962.

The average relative humidity in midafternoon is about 62 percent. Humidity is higher at night, and the average at dawn is about 82 percent. The sun shines 62 percent of the time possible in summer and 32 percent in winter. The prevailing wind is from the west. Average windspeed is highest, 11.5 miles per hour, in January.

History and Development

The earliest inhabitants of what is now Van Buren County were an agriculturally based people who formed settlements in openings in the dense hardwood forests and along watercourses, between 1,000 and 1,500 years ago. Traces of large garden plots and artifact-laden burial mounds were discovered by the early permanent settlers.

The earliest permanent settlers came to the area from New England in the late 1820's. At the time, the area was inhabited by Potawatomi, Ottawa, and Chippewa Indians, who had already lost title to the land under the Chicago Treaty of 1821. The area was part of Monroe County until 1829, when the Legislative Council of Michigan defined the present boundaries and made the village of Paw Paw the county seat. The county was named after Secretary of State Martin Van Buren. In March 1837, it became self-governing and elected its first public officials (*3*).

The commercial and cultural development of Van Buren County has been strongly influenced by its abundance of inland lakes, rivers, streams, and marshes and by its proximity to Lake Michigan. Early travel was by means of primitive roads, Indian trails, and waterways. Flatboats were used to transport various wood and, later, agricultural products along the Paw Paw and Black Rivers to the shipping points of South Haven and St. Joseph (*6*). River transport started to become obsolete with the completion of the Michigan Central Railroad in 1845. With the advent of the railroads, towns became important central points of shipping. Lawton, for example, was built where the Mission Indian Trail crossed the Michigan Central Railroad.

The extensive, though scattered, wetlands in the county were developed for special kinds of agricultural uses. Once timber became less available, the local economy turned toward specialized agriculture. The sandy wetlands in the northwestern part of the county were ideally suited to blueberry production, while the mucks in the central and southern parts were used for such crops as spearmint, radishes, carrots, and celery.

The moderating effect of Lake Michigan on the climate provided a good environment for extensive fruit tree production. The first commercial orchards were planted along the lake in 1852. The earliest vineyards were established in Lawton in 1867.

Many of the population centers in the county were established near water areas. The village of Paw Paw was founded at the confluence of the south and east branches of the Paw Paw River. Lawrence and Hartford are along the main branch of the Paw Paw, and Bangor is along the Black River. South Haven, which is at the mouth of the Black River, became a flourishing Lake Michigan port by the 1870's.

Population trends in the county have shown a steady increase during all periods, except for the years of the Great Depression. In 1850, the population was 5,800. In 1980, it was 69,000. The county has a much higher growth rate than the rest of the state. The largest municipality is South Haven, a coastal town in the northwest corner of the county. In 1980, it had a population of 5,943. In that year, Paw Paw had a population of 3,211. Growth is most rapid in east-central part of the county (*7*). The bedroom communities in this area are growing quickly because of their proximity to Kalamazoo (*13*).

Land Uses

Van Buren County is primarily a rural county that has scattered pockets of urban areas. About 227,329 acres, or 57.2 percent of the total area, is used for agricultural purposes. About 115,994 acres, or 29.2 percent of the total acreage, is forest land, which includes deciduous and coniferous forests and brush land. About 24,023 acres, or 6.0 percent of the total acreage, is wetlands, including wooded swamps, shrub swamps, and marshes. Only 17,361 acres is developed for residential uses. The rest of the county consists of inland lakes, streams, ponds, and reservoirs, and areas used for commercial, industrial, and other purposes.

Geology

The landscape of Van Buren County was formed by the complex action of the Lake Michigan Lobe of the Wisconsin glacial ice sheet. The glacial action resulted in five dominant features—moraines, till plains, outwash plains, lake plains and drainageways, and areas where muck and silt were deposited by ponded water on till plains. Some areas of the moraines and till plains were modified by windblown sand, and some areas of the till plains were modified by shallow water.

Three major moraines traverse the county in a generally northeast-southwest line (*8*). The Kalamazoo morainic system is in the southeast corner of the county. It is spotted with outwash plains. The Valparaiso morainic system makes up a large part of the county.

One very broad ridge is in the southern part of the county, and three ridges are in the northern part. Also part of the Valparaiso system are numerous outlying moraines on the till plain in the western part of the county. The Lake Border morainic system in Van Buren County occurs only as one narrow ridge roughly paralleling the shore of Lake Michigan. This ridge is 1.5 to 4 miles inland.

The till plains are fairly well scattered throughout the county. A bank of till 2 to 4 miles wide is between Bloomingdale and Gobles, starting about 1 mile south of the Allegan County line and ending about 2 miles southeast of Glendale. A large till plain modified by shallow water is in the area west of a line from Lacota to near the Hartford. A narrow band of till is directly west of the Lake Border moraine. Many small till plains are throughout the county.

The outwash plains are mainly in the southeastern part of the county. The largest one is between Keeler and Decatur, running from the Cass County line northeastward to an area near the Paw Paw River between Lawrence and Paw Paw. The other outwash areas are smaller and are on the eastern side of the moraines.

The lake plain areas include a band of material directly east of the sand dunes along Lake Michigan, the western half of Geneva Township, and an area near Grand Junction that was part of a glacial lake. The drainageways are those along the Paw Paw River and Dowagiac Creek and the drainageway north of Mentha. All of these drainageways are connected to one another.

Two areas in the county were affected by ponded water rather than glacial lakes. One area includes most of the southeast corner of Columbia Township and most of the northeast corner of Arlington Township. The other is a much smaller area around Kendall, in Pine Grove Township.

Other geological features in the county are kames; sand dunes; a few large erratics, or boulders, left by the glacier; and, in gravel pits, beds of "crag," which formed when calcium carbonate was deposited around individual pebbles and cobbles in a gravel bed.

The thickness of the drift in Van Buren County ranges from about 140 to 532 feet. The drift is thickest in two roughly parallel bands extending northeast to southwest, one through the Bangor area and the other through the Lawton area.

Relief

Topography in Van Buren County ranges from knobby ridges and basinlike depressions in the terminal moraine areas to gentle slopes and flat bottom land on the outwash and river flood plains. The hills of the Kalamazoo moraine rise 160 to 190 feet above the till plain and Paw Paw Lake. The internal relief on the moraine is 50 to 75 feet. The basins are 25 feet or more below the outwash level. The hills of the Valparaiso moraine rise as much as 150 feet above the surrounding areas. Relief on this moraine varies considerably across the county. The Lake Border moraine has little relief. The highest elevation in the county is about 1,060 feet above sea level, in Antwerp Township, section 35.

Drainage

The soils in Van Buren County range from excessively drained on the sand dunes to very poorly drained in the marshes and river bottoms. In areas where sandy material overlies finer textured material, the soils are somewhat poorly drained or poorly drained. A drainage system is needed if the more nearly level areas of the finer textured soils are farmed. Most areas of muck have been drained and are farmed.

Numerous depressions, kettle holes, and lakes are throughout the county. Only a few of the lakes are marshy or swampy. Some are connected by streams through bordering swamps, and some have well defined outlets.

The chief watercourses in the county are the Paw Paw River, the South Branch of the Black River, and their tributaries. The watershed of the Paw Paw River includes about 346 square miles. That of the South Branch of the Black River includes about 160 square miles. About 26 or 27 square miles in the northeast corner of the county is drained by the Kalamazoo River. The Rocky River and Dowagiac Creek drain about 56 square miles in the southeastern and south-central parts of the county. About 37 square miles along Lake Michigan is drained by small streams emptying directly into the lake. Along the borders of lakes and streams are numerous swamps and marshes, some of which are fairly extensive.

The waterway and stream patterns in the county are immature. Some nearly level and undulating areas have no definite drainage pattern. Floods and long periods of high water are not serious problems in the county.

Beach erosion is a problem in many areas along the shore of Lake Michigan. As they are undercut by the action of waves and ice, the clay cliffs slump, moving the shoreline farther inland. Some of the banks have been partially stabilized by jetties, but the problem has never been completely solved.

Native Vegetation

Most of Van Buren County was at one time covered with forest vegetation. Numerous openings were in the oak forests in the southern part of the county. The extreme northern part and the area along Lake Michigan were covered by white pine and hemlock. The hardwood forests included beech, maple, whitewood, basswood, elm, ash, black walnut, butternut, oak, cherry, linden, tamarack, aspen, hickory, and sycamore. The swamps were covered by black ash and tamarack.

The openings in the forests in the southern part of the county were created when the Indians burned underbrush. The openings were covered by tall grasses and numerous wild flowering plants. These areas could be more easily prepared for cultivation than the other areas and were the first to be used for farming. Later, the forests were cleared and the ground was broken. Some of the mucky lowland was cleared and used for agriculture. The present forests in Van Buren County consist of small farm woodlots and narrow bands of woodland along wet stream bottoms.

Agriculture

Agriculture in Van Buren County is extremely diverse because of a wide variety of soils, extremes in relief, the moderating effects of Lake Michigan on the climate, and the availability of ground water for irrigation.

Apples, peaches, tart and sweet cherries, and vineyards are the major tree and vine fruits. They are grown on the highest sites, where air drainage is good. Because of its proximity to Lake Michigan, the western half of the county tends to be more frost free than the eastern half. Several extensive areas on the moraines in the eastern half, however, are good sites for tree and vine fruits. These are in Porter, Antwerp, and Paw Paw Townships. Some areas in the county are used for plum and pear orchards.

Vegetables are generally grown in the southern half of the county, especially in the southwest quarter. Asparagus is grown on coarse textured, excessively drained soils. Other vegetables and small fruit crops, such as cucumbers, peppers, tomatoes, strawberries, melons, and snap beans, are grown on well drained, coarse textured to medium textured soils. These crops are irrigated. Some raspberries also are grown. The production of fruit tree nursery stock and Christmas tree plantations are important enterprises.

Blueberries are suited to poorly drained, acid sands and mucks (fig. 1). They are grown primarily in the northwestern part of the county.

Two major areas of mucky soils are in the Mentha area of Pine Grove Township and in Decatur Township. These mucks have been drained and are used for some vegetable crops, such as onions, radishes, carrots, celery, cabbage, and cauliflower. Corn is the primary grain grown in the areas of muck near Decatur. Some areas are used for sod farming.

The rest of the agriculture in the county consists of a broad spectrum of livestock enterprises, grain crops, and hay. The livestock are mainly hogs, beef cattle, and dairy cows. They also include sheep and poultry. The grain crops include corn, soybeans, wheat, and oats. Alfalfa is the primary hay crop. Irrigation is becoming increasingly common in the areas used for grain crops. Van Buren County currently has the largest number of irrigators in the state. It ranks third in acres irrigated.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

Figure 1.—An area of the Pipestone-Kingsville complex, 0 to 3 percent slopes, used for blueberries.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some of the boundaries on the general soil map of Van Buren County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Soil Descriptions

1. Oakville Association

Undulating to very steep, well drained, sandy soils on beach ridges and dunes

This association makes up 2 percent of the county. It is about 85 percent Oakville soils and 15 percent soils of minor extent (fig. 2).

Typically, the surface layer of the Oakville soils is very dark grayish brown fine sand about 4 inches thick. The subsurface layer is brown fine sand about 5 inches thick. The subsoil is yellowish brown and brownish yellow, loose fine sand about 23 inches thick. The substratum to a depth of 60 inches is very pale brown fine sand.

The soils of minor extent in this association are the excessively drained Plainfield soils, the moderately well drained Covert soils, the somewhat poorly drained Brems soils, and the poorly drained Kingsville and Glendora soils. Plainfield soils are in landscape positions similar to those of the Oakville soils. Covert, Brems, and Kingsville soils are in drainageways and shallow depressions. Glendora soils are along river bottoms.

Most areas in this association are wooded. Small areas have bean cleared for building site development and recreation uses. The Oakville soils are well suited to woodland and are generally unsuited to cultivated crops. Erosion, the equipment limitation, and seedling mortality are concerns in managing woodland.

Depending on the slope, the Oakville soils range from fairly well suited to generally unsuited to building site development and septic tank absorption fields. A poor filtering capacity and the slope are the major management concerns. These soils are poorly suited to recreational development. The major management concerns are the slope and the sandy texture.

2. Kingsville-Covert-Pipestone Association

Nearly level and undulating, poorly drained to moderately well drained, sandy soils on lake plains and outwash plains

This association makes up about 6 percent of the county. It is about 45 percent Kingsville soils, 25 percent Covert soils, 20 percent Pipestone soils and 10 percent soils of minor extent (fig. 3).

The Covert soils are in the higher positions on sandy ridges. The Pipestone soils are on the slightly lower knolls, and the Kingsville soils are on broad flats.

Kingsville soils are nearly level and poorly drained. Typically, the surface layer is very dark gray loamy sand about 8 inches thick. The subsoil is mottled sand about 22 inches thick. The upper part dark grayish brown, and the lower part is light brownish gray. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown sand.

Covert soils are nearly level and undulating and are moderately well drained. Typically, the surface layer is very dark grayish brown sand about 8 inches thick. The subsurface layer is light brownish gray sand about 7 inches thick. The subsoil is dark reddish brown and strong brown sand about 20 inches thick. The ubstratum to a depth of about 60 inches is pale brown, mottled sand.

Pipestone soils are nearly level and somewhat poorly drained. Typically, the surface layer is very dark grayish brown fine sand about 9 inches thick. The subsurface layer is grayish brown, mottled fine sand about 5 inches

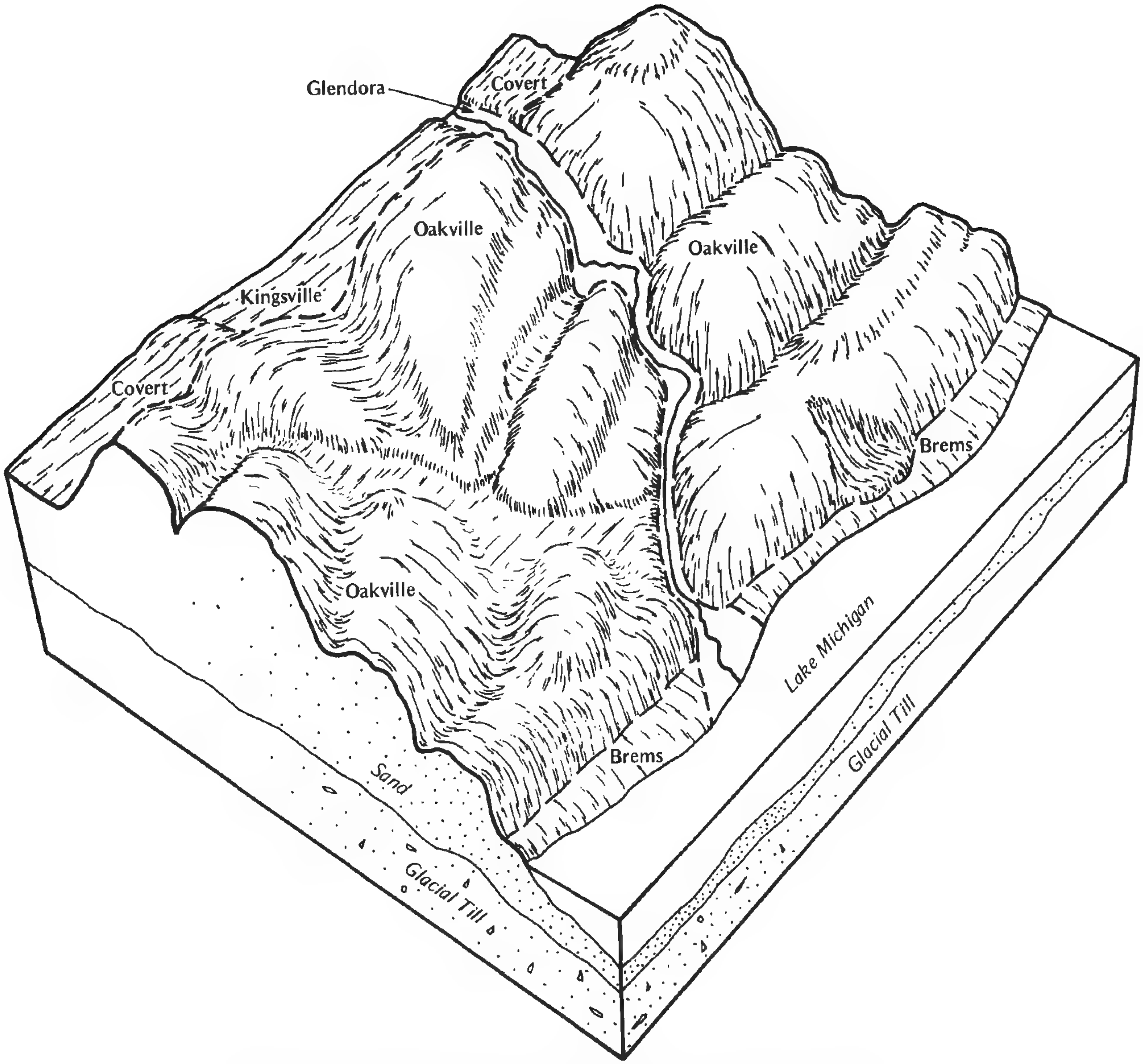

Figure 2.—Pattern of soils and underlying material in the Oakville association.

thick. The subsoil is about 12 inches thick. It is mottled. The upper part is dark brown and dark reddish brown fine sand, and the lower part is dark reddish brown sand. The substratum to a depth of about 60 inches is yellowish brown, mottled fine sand.

The soils of minor extent in this association are the excessively drained Grattan and Plainfield soils, the somewhat poorly drained Selfridge soils, and the poorly drained and very poorly drained Belleville soils. Grattan and Plainfield soils are in the higher landscape positions. Selfridge soils are in landscape positions similar to those of the Pipestone soils. Belleville soils are in depressional areas.

Most areas in this association are used for specialty crops or woodland or are idle. If drained, the major soils generally are suited to cropland. Wetness, droughtiness, and soil blowing are the main concerns in managing cropland. Surface and subsurface drains are needed. All of the major soils are fairly well suited or poorly suited to woodland. Wetness and droughtiness are the major concerns in managing woodland.

The major soils are poorly suited or generally unsuited to building site development and sanitary facilities. Wetness and a poor filtering capacity are the major limitations.

3. Capac-Riddles-Selfridge Association

Nearly level to hilly, somewhat poorly drained and well drained, loamy and sandy soils on till plains, moraines, and lake plains

This association makes up about 36 percent of the county. It is about 40 percent Capac soils, 30 percent Riddles soils, 20 percent Selfridge soils, and 10 percent soils of minor extent (fig. 4).

Capac soils are nearly level and gently sloping and are somewhat poorly drained. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is grayish brown loam, the next part is brown clay loam, and the lower part is grayish brown clay loam. The substratum to a depth of about 60 inches is brown, mottled loam.

Riddles soils are nearly level to hilly and are well drained. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is brown clay loam about 9 inches thick. The subsoil is dark yellowish brown clay loam and sandy clay loam about 28 inches thick. The substratum to a depth of about 60 inches is dark yellowish brown clay loam.

Selfridge soils are nearly level and somewhat poorly drained. Typically, the surface layer is dark grayish brown loamy sand about 12 inches thick. The subsurface layer is yellowish brown and reddish yellow sand about 21 inches thick. The subsoil is about 5 inches thick. It is brown and mottled. The upper part is sandy loam, and

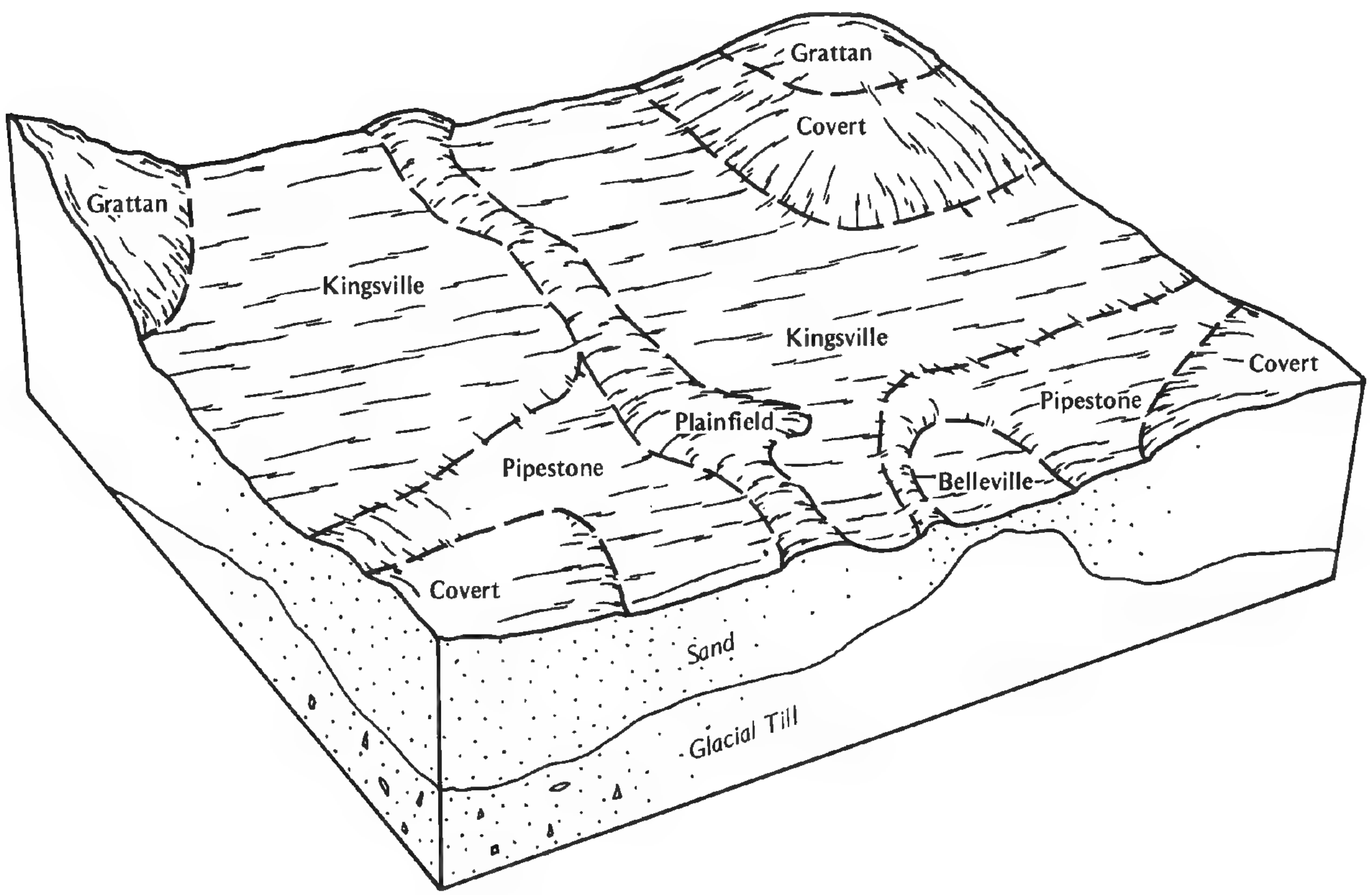

Figure 3.—Pattern of soils and underlying material in the Kingsville-Covert-Pipestone association.

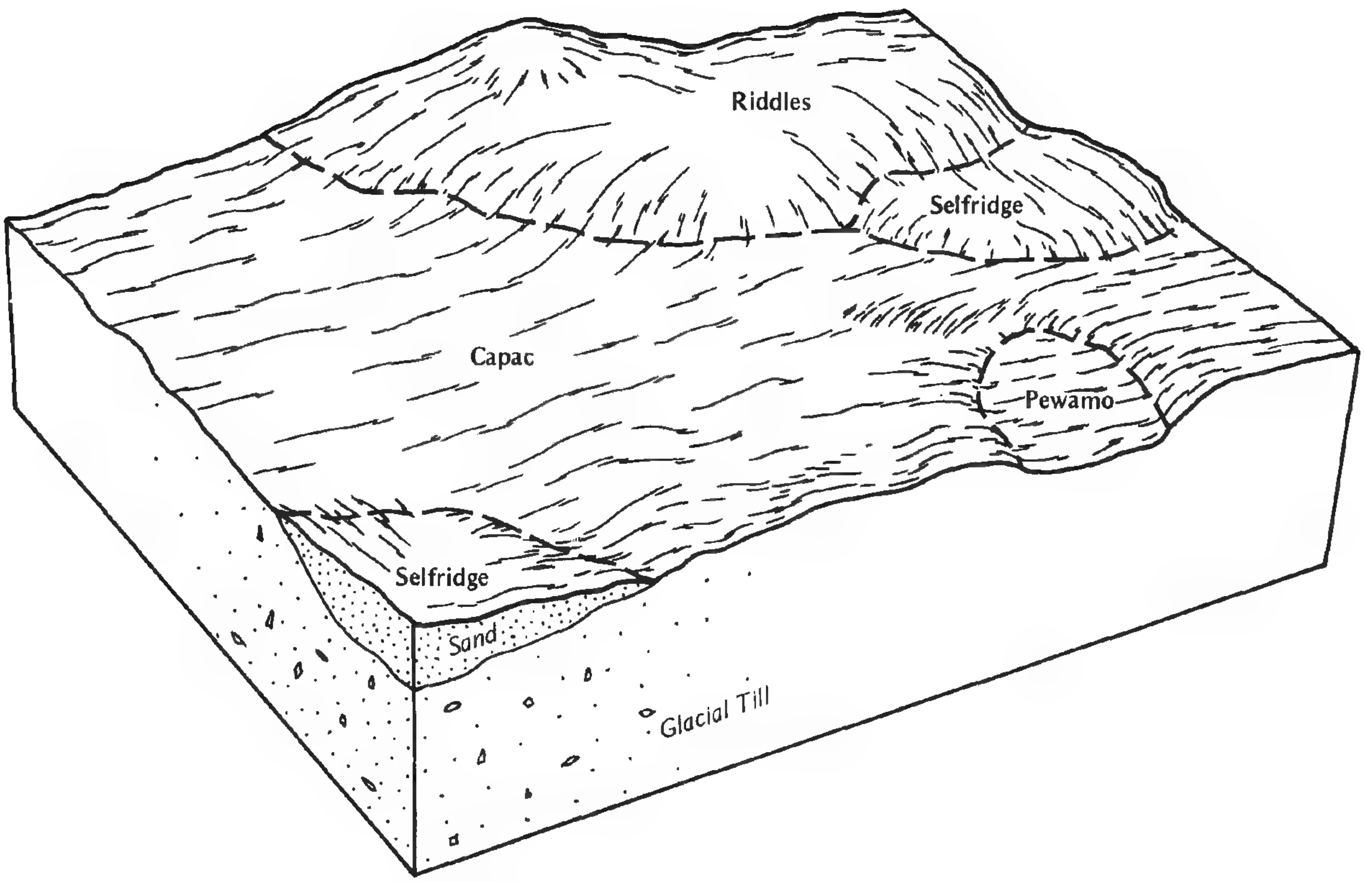

Figure 4.—Pattern of soils and underlying material in the Capac-Riddles-Selfridge association.

the lower part is clay loam. The substratum to a depth of about 60 inches is brown, mottled silty clay loam.

The soils of minor extent in this association are the well drained Metea soils and the poorly drained Pewamo soils. Metea soils are coarse textured in the upper part. They are in landscape positions similar to those of the Riddles soils. Pewamo soils are in natural drainageways and in the lower areas.

Most areas in this association are used as cropland. The major soils are well suited or fairly well suited to cropland and woodland. The wetness of the somewhat poorly drained soils and erosion on the well drained soils are the main concerns in managing cropland. Also, droughtiness is a concern in managing the sandy soils. Seedling mortality is the major concern in managing the sandy soils for woodland.

The major soils range from well suited to generally unsuited to building site development and sanitary facilities. The nearly level and undulating, well drained soils are well suited. The slope of the gently rolling to hilly soils and the wetness of the somewhat poorly drained soils are limitations.

4. Oshtemo-Kalamazoo Association

Nearly level to gently rolling, well drained, loamy soils on glacial outwash plains

This association makes up about 8 percent of the county. It is about 50 percent Oshtemo soils, 40 percent Kalamazoo soils, and 10 percent soils of minor extent. The Oshtemo and Kalamazoo soils are in broad, nearly level areas and on knolls and ridges throughout the association.

Typically, the surface layer of the Oshtemo soils is dark brown sandy loam about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 8 inches thick. The subsoil is strong brown sandy loam about 23 inches thick. The substratum to a depth of about 60 inches is brownish yellow gravelly sand.

Typically, the surface layer of the Kalamazoo soils is dark brown loam about 10 inches thick. The subsoil is about 37 inches thick. In sequence downward, it is brown, very friable sandy loam; brown, friable sandy clay loam; brown, very friable sandy loam; strong brown, very friable gravelly sandy loam; and strong brown, loose

gravelly sand. The substratum to a depth of about 60 inches is strong brown gravelly sand.

The soils of minor extent in this association are the well drained Coloma and Spinks soils. These soils are coarser textured throughout than the major soils. They are in positions on the landscape similar to those of the major soils.

Most areas in this association are used as cropland. The major soils are well suited or fairly well suited to cropland and are well suited to woodland. Erosion and soil blowing are hazards in managing cropland. No major hazards or limitations affect planting or harvesting in the wooded areas.

The major soils are well suited or fairly well suited to building site development and sanitary facilities. The slope of the gently rolling soils is a limitation.

5. Coloma-Spinks-Oshtemo Association

Nearly level to hilly, somewhat excessively drained and well drained, sandy and loamy soils on outwash plains and moraines

This association is on broad flats and on hills and ridges. It makes up about 40 percent of the county. It is about 35 percent Coloma soils, 30 percent Spinks soils, 20 percent Oshtemo soils, and 15 percent soils of minor extent (fig. 5).

Coloma soils are nearly level to hilly and are somewhat excessively drained. Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is dark yellowish brown loamy sand about 24 inches thick. The subsoil to a depth of about 60 inches is yellowish brown sand that has thin lamellae of strong brown loamy sand.

Spinks soils are nearly level to gently rolling and are well drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is dark yellowish brown loamy sand and yellowish brown sand about 21 inches thick. The subsoil to a depth of about 60 inches is light yellowish brown, loose sand that has thin lamellae of dark brown, very friable loamy sand.

Oshtemo soils are nearly level to hilly and are well drained. Typically, the surface layer is dark brown sandy loam or loamy sand about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 8 inches thick. The subsoil is strong brown sandy loam

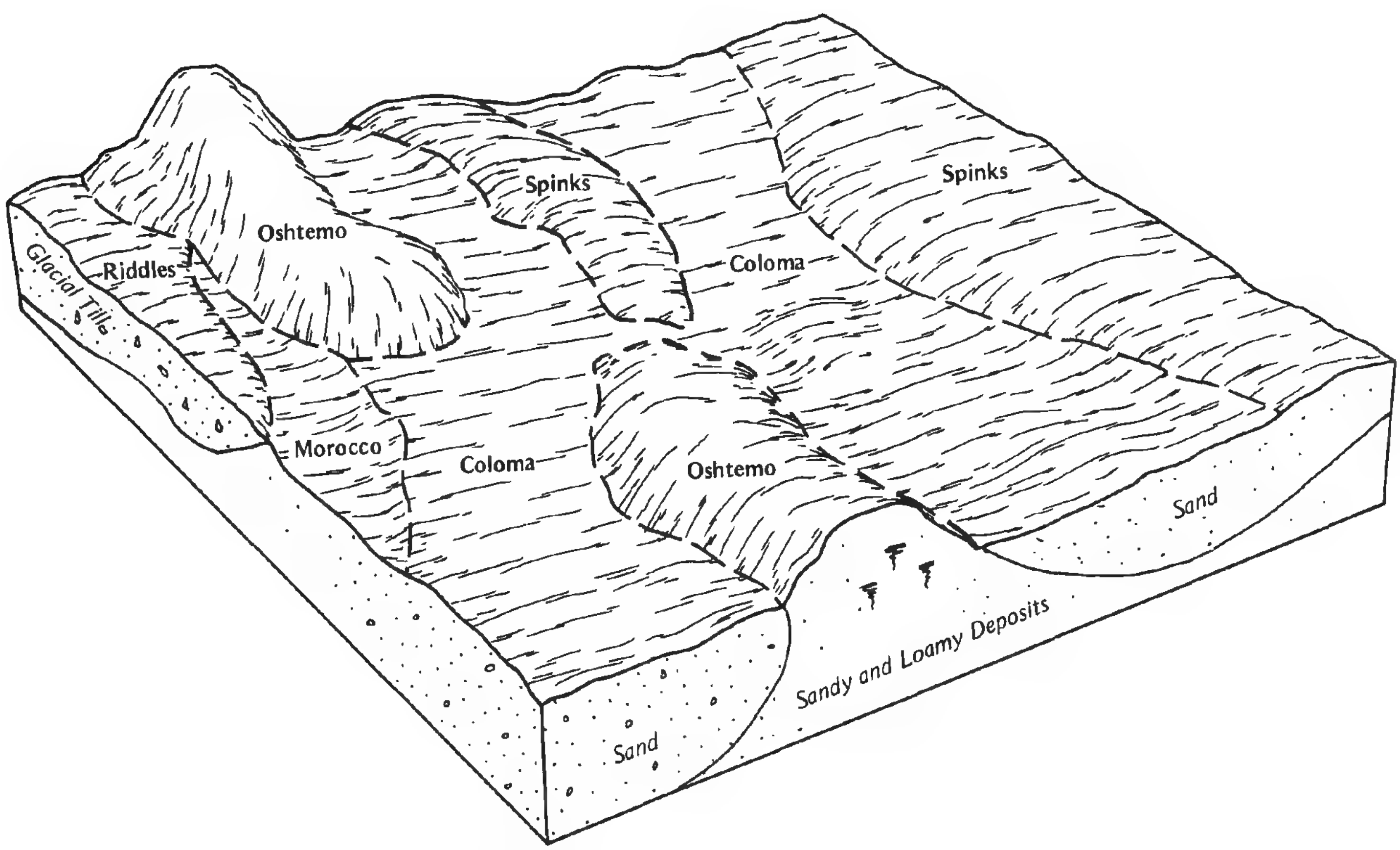

Figure 5.—Pattern of soils and underlying material in the Coloma-Spinks-Oshtemo association.

about 23 inches thick. The substratum to a depth of about 60 inches is brownish yellow gravelly sand.

The soils of minor extent in this association are the excessively drained Plainfield soils, the well drained Riddles soils, the moderately well drained Brems soils, and the somewhat poorly drained Morocco soils. Plainfield and Riddles soils are in positions on the landscape similar to those of the major soils. Riddles soils are loamy. Brems and Morocco soils are in the slightly lower landscape positions.

Most areas in this association are used as cropland. The nearly level and undulating soils are generally used for specialty crops. Most of the rolling and hilly soils are used as woodland.

The nearly level and undulating soils are well suited or fairly well suited to cropland. The rolling and hilly soils generally are poorly suited or unsuited. Erosion, soil blowing, and drought are hazards in managing cropland. All of the major soils are well suited to woodland. Seedling mortality is the major concern in managing the sandy soils for woodland.

The major soils range from well suited to generally unsuited to building site development and sanitary facilities. The nearly level and undulating soils are well suited. The slope of the gently rolling to hilly soils and a poor filtering capacity in the sandy soils are limitations.

6. Gilford Association

Nearly level, very poorly drained, loamy soils on outwash plains

This association makes up 4 percent of the county. It is about 80 percent Gilford soils and 20 percent soils of minor extent.

Typically, the surface layer of the Gilford soils is black sandy loam about 14 inches thick. The subsoil is about 21 inches thick. The upper part is very dark grayish brown and light brownish gray, friable sandy loam; the next part is grayish brown, friable loamy sand; and the lower part is very dark grayish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is dark grayish brown loamy sand and grayish brown loamy fine sand.

The soils of minor extent in this association are the poorly drained Colwood soils and the somewhat poorly drained Matherton soils. Colwood soils are in positions on the landscape similar to those of the Gilford soils. Matherton soils are on the slightly higher rises and knolls.

Most areas of this association are used as woodland. Some are used as cropland, and others are left idle. The Gilford soils are generally unsuited to cultivated crops but are well suited or fairly well suited to woodland. Wetness is the main concern in managing cropland. Most areas do not have suitable drainage outlets. A few have been drained and are farmed. The equipment limitation, seedling mortality, and the windthrow hazard are the major concerns in managing woodland.

The Gilford soils are generally unsuited to building site development and sanitary facilities. The major management concerns are ponding, a poor filtering capacity, and seepage.

7. Adrian-Edwards-Houghton Association

Nearly level, very poorly drained, mucky soils in old glacial lakebeds, on flood plains, and in drainageways

This association makes up about 4 percent of the county. It is about 55 percent Adrian soils, 20 percent Edwards soils, 15 percent Houghton soils, and 10 percent soils of minor extent.

Typically, Adrian soils are black muck in the upper part and dark gray sand in the substratum, Edwards soils are black muck in the upper part and light gray marl in the substratum, and Houghton soils are black muck throughout.

The soils of minor extent in this association are the very poorly drained Palms and Gilford soils. These soils are in positions on the landscape similar to those of the major soils. Palms soils are underlain by a loamy substratum. Gilford soils formed in sandy and loamy material.

Most areas in this association are used as cropland. Some are used as woodland. If drained, the major soils are well suited to cropland. They are fairly well suited to woodland. Ponding, wetness, and soil blowing are the major concerns in managing cropland. Wetness, ponding, and the windthrow hazard are the major concerns in managing woodland.

The major soils are generally unsuited to building site development and septic tank absorption fields. The major management concerns are ponding and wetness.

Broad Land Use Considerations

By indicating the suitability of groups of soils for various types of land use, the descriptions of the associations on the general soil map provide information that can be used as a basis for making broad land use and management decisions. Certain soil properties and environmental factors may prohibit a particular land use in a given area.

The primary land uses in the county are agricultural, though forested lands and wetlands cover extensive areas. Recreation, transportation, and industrial facilities make up a small portion of the acreage in the county. The most intensive land use in the county is urban development. Because of its proximity to Kalamazoo, the Paw Paw-Mattawan area, along Interstate 94, is being developed more rapidly than other areas in the county. Urban development continues to expand in South Haven, the county's largest urban area.

Urban development can cause severe environmental stress. The soil properties that most strongly affect urban development are the depth to a seasonal high

water table, the slope, permeability, and the hazards of seasonal ponding and flooding.

Of the major soils in the county, the ones in the Oshtemo-Kalamazoo and Coloma-Spinks-Oshtemo associations have the fewest limitations for urban development. The main limitations are droughtiness and rapid permeability. The droughtiness of the Coloma and Spinks soils can adversely affect lawns and trees in summer. All of the major soils in these associations are underlain by sand or gravelly sand. As a result, permeability is rapid in the lower part of the profile and seepage can be a major problem. Suitable sites for sanitary facilities and landfills are not available in all areas.

Of the other associations in the county, only the Capac-Riddles-Selfridge association has major soils that are well suited to urban development. These are the Riddles soils, which are extensively used for agricultural purposes. The other associations are made up of soils that are too wet or too sandy or are subject to ponding or flooding. Urban development is possible on these soils, but many costly management practices would be needed to overcome the limitations. The major soils in the Oakville association are limited as sites for urban uses by sand dunes, the slope, and a sandy surface. These soils become unstable and erosive if their natural vegetation is disturbed during residential or industrial development.

Most of the associations can be used for agricultural purposes. The major soils in the Oshtemo-Kalamazoo association are best suited to farming. The more sloping soils in this association are also used for wine grapes.

The major soils in the Kingsville-Covert-Pipestone, Capac-Riddles-Selfridge, and Coloma-Spinks-Oshtemo associations also are suited to farming. More intensive management measures, such as a drainage system and applications of lime and fertilizer, are needed. The Kingsville and Pipestone soils in Kingsville-Covert-Pipestone association are particularly well suited to blueberry production if they are drained. The steeper areas of Riddles soils in the Capac-Riddles-Selfridge association are commonly used for fruit trees. Wine grapes are best suited to the moderate slopes in the Coloma-Spinks-Oshtemo association. Measures that help to control erosion are needed in the areas used for tree fruits and wine grapes.

The major soils in the Adrian-Edwards-Houghton association can be used for agricultural purposes, especially specialty crops, if a drainage system is installed. The major soils in the Gilford association are generally unsuitable for crop production because of wetness, and the major soils in the Oakville association are unsuitable because of droughtiness and the slope.

Those associations that are not well suited to agriculture or urban development can be used for timber production or as recreation areas. The slope and extreme wetness inhibit large-scale harvesting of timber. The more gently sloping areas in the Capac-Riddles-Selfridge and Coloma-Spinks-Oshtemo associations provide good access for harvesting equipment. Some areas of the Gilford and Adrian-Edwards-Houghton associations are used for hardwoods, which are harvested during the drier periods. Private woodlots are throughout the county, on many different kinds of soil. Intensive harvesting techniques are not needed on these small wooded tracts. The woodlots are a source of firewood and provide good habitat for wildlife.

The extremely wet soils in the Gilford and Adrian-Edwards-Houghton associations are well suited to wetland wildlife habitat. Areas where lakes and rivers are abundant can be developed for recreation uses. The prime recreation area in the county is mainly in the Oakville association. Though the dunes in this association are easily eroded if overused, this area can be used for a variety of recreational purposes if it is properly managed.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Riddles sandy loam, 1 to 6 percent slopes, is one of several phases in the Riddles series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. The Algansee-Cohoctah complex is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Aquents and Histosols, ponded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some of the boundaries on the detailed soil maps of Van Buren County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and variations in the intensity of mapping or in the extent of the soils within the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

3B—Coloma loamy sand, 0 to 6 percent slopes. This nearly level and undulating, somewhat excessively drained soil is on knolls and small ridges. Areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is dark yellowish brown, friable and loose loamy sand and sand about 24 inches thick. Below this to a depth of about 60 inches is yellowish brown loose sand that has thin lamellae of strong brown loamy sand. In some places the soil does not have lamellae. In other places the total thickness of the lamellae is more than 6 inches.

Permeability is rapid. Available water capacity is low. Surface runoff is slow.

Most areas of this soil are farmed. Some are used as woodland.

This soil is poorly suited to cropland, but corn, small grain, soybeans, hay, and specialty crops, such as cherries, asparagus, strawberries, and grapes, can be grown. The major management concerns are droughtiness, the organic matter content, and soil blowing. Field windbreaks, wind stripcropping, and winter cover crops help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and reduce droughtiness. Irrigation reduces the droughtiness and the susceptibility to soil blowing.

Because of the droughtiness, this soil is only fairly well suited to pasture. Adding animal manure or incorporating green manure crops into the soil increases the moisture supply. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concern is a high seedling mortality rate. Special planting stock and overstocking can help to overcome this limitation.

This soil is well suited to building site development but is poorly suited to septic tank absorption fields and sewage lagoons. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields and sewage lagoons. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IVs. The Michigan soil management group is 5a.

3C—Coloma loamy sand, 6 to 12 percent slopes. This gently rolling, somewhat excessively drained soil is on ridges and the sides of knolls in the uplands. Areas are commonly irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown loamy sand and brownish yellow sand about 31 inches thick. The subsoil is about 10 inches of brownish yellow, loose sand that has very thin lamellae of strong brown loamy sand. The substratum to a depth of about 60 inches is yellowish brown sand that has thin lamellae of strong brown loamy sand. In places the total thickness of the lamellae is more than 6 inches.

Permeability is rapid. Available water capacity is low. Surface runoff is medium.

Most areas of this soil are wooded. Some are farmed or are used for building site development.

This soil is poorly suited to cultivated crops, but corn, small grain, soybeans, and specialty crops, such as asparagus, cherries, and grapes, can be grown. The major management concerns are droughtiness, water erosion, soil blowing, and the organic matter content. Field windbreaks and wind stripcropping help to control soil blowing and water erosion. Returning crop residue to the soil and plowing green manure crops under increase the organic matter content and reduce the droughtiness.

This soil is poorly suited to pasture. The major management concerns are droughtiness and water erosion. Incorporating animal manure and green manure crops into the surface layer increases the moisture supply. Rotation or strip grazing helps to maintain the plant cover and thus reduces the susceptibility to erosion.

This soil is fairly well suited to woodland. The major management concern is a high seedling mortality rate. Special planting stock and overstocking may be necessary to compensate for seedling losses.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields and sewage lagoons because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields and sewage lagoons. The poor filtering capacity can result in the pollution of ground water supplies. Lining sewage lagoons with impermeable material helps to prevent seepage. Land leveling is necessary on sites for the lagoons.

The land capability classification is IVs. The Michigan soil management group is 5a.

4B—Blount silt loam, 0 to 4 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on convex slopes and in concave areas in drainageways and depressions. Areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is yellowish brown, firm silty clay, and the lower part is dark yellowish brown, very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled clay loam. In places the subsoil and substratum have less clay.

Permeability is moderately slow or slow. Available water capacity is high. Surface runoff is medium or slow. The seasonal high water table is at a depth of 1 to 3 feet from January to May.

Most areas of this soil are farmed. Some of the acreage is idle land or woodland.

This soil is fairly well suited to corn, soybeans, wheat, and specialty crops, such as apples. The major management concerns are removing excess water and maintaining good tilth. A combination of a surface drainage system and subsurface tile reduces the wetness. Good tilth can be maintained by restricting fieldwork during wet periods and by applying a system of conservation that does not invert the soil and that leaves all or part of the crop residue on the surface.

Because of the excess water, this soil is only fairly well suited to pasture. Grazing after heavy rains usually results in surface compaction, excessive runoff, and poor tilth. Rotation or strip grazing and timely deferment of grazing help to maintain good tilth in the pastured areas.

This soil is moderately well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Because the soil is sticky when wet, equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate in some areas. Carefully thinning the stands or not thinning them at all reduces the windthrow hazard.

Because of the shrink-swell potential and the wetness, this soil is poorly suited to building site development. It is generally unsuited to septic tank absorption fields because of the moderately slow or slow permeability and the wetness. It is well suited to sewage lagoons. If buildings are constructed, additions of suitable fill material are needed to raise the site.

The land capability classification is IIw. The Michigan soil management group is 1.5b.

6B—Oshtemo sandy loam, 0 to 6 percent slopes. This nearly level and undulating, well drained soil is on broad slopes and low ridges and knolls. Areas are irregular in shape and range from 3 to about 300 acres in size.

Typically, the surface layer is dark brown sandy loam about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 8 inches thick. The subsoil is strong brown, very friable and friable sandy loam about 23 inches thick. The substratum to a depth of about 60 inches is brownish yellow gravelly sand. In some places the subsoil has more clay. In other places the upper part of the subsoil is more sandy.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. Some are used as woodland.

This soil is fairly well suited to corn, soybeans, wheat, asparagus, cherries, apples, strawberries, and grapes. The major management concerns are droughtiness, the content of organic matter, and soil blowing. Returning crop residue to the soil and applying a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface reduce the droughtiness and the susceptibility to soil blowing and increase the organic matter content. Irrigation is needed in the areas used for corn, cherries, apples, strawberries, or grapes.

Because of the droughtiness, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the surface layer increases the moisture supply.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is well suited to building site development and septic tank absorption fields. It is poorly suited to sewage lagoons because of seepage. Lining the lagoon with impervious material helps to prevent seepage.

The land capability classification is IIIs. The Michigan soil management group is 3a.

6C—Oshtemo sandy loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on ridges and knolls on outwash plains. Areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is dark yellowish brown, friable sandy loam and sandy clay loam about 34 inches thick. The substratum to a depth of about 60 inches is yellowish brown sand that has thin bands of dark yellowish brown sandy loam. In some places the subsoil has more clay. In other places the upper part of the subsoil is more sandy.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is medium.

Most areas of this soil are used as cropland. Some are used as woodland.

This soil is fairly well suited to cropland. The major management concerns are water erosion, soil blowing, droughtiness, and the content of organic matter. Returning crop residue to the soil, planting cover crops, and applying a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to prevent excessive soil loss, reduce the droughtiness, and increase the organic matter content. Grassed waterways help to control erosion. Irrigation is needed in the areas used for corn and specialty crops, such as cherries, apples, and grapes.

This soil is fairly well suited to pasture. The major management concerns are droughtiness and water erosion. Incorporating animal manure and green manure crops into the surface layer increases the moisture supply. Overgrazing during dry periods can destroy the plant cover. Rotation grazing and deferment of grazing during dry periods help to maintain the plant cover and thus reduce the susceptibility to erosion.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the slope, this soil is only fairly well suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

Because of seepage and the slope, this soil is poorly suited to sewage lagoons. Extensive land shaping is

needed. Lining of the lagoon with impervious material helps to prevent seepage.

The land capability classification is IIIe. The Michigan soil management group is 3a.

6D—Oshtemo-Coloma loamy sands, 12 to 18 percent slopes. These rolling soils are on convex ridgetops and on knolls and side slopes. The Oshtemo soil is well drained, and the Coloma soil is somewhat excessively drained. Areas are irregular in shape and range from 5 to 180 acres in size. They are about 60 percent Oshtemo soil and 40 percent Coloma soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Oshtemo soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsoil is about 31 inches thick. The upper part is dark brown and dark yellowish brown, friable sandy clay loam, and the lower part is strong brown, loose loamy sand. The substratum to a depth of about 60 inches is light yellowish brown fine sand that has thin lamellae of dark yellowish brown loamy fine sand. In places the lower part of the subsoil has more clay.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 10 inches thick. The subsurface layer is about 24 inches thick. It is yellowish brown loamy sand and brownish yellow sand. The subsoil is about 10 inches of brownish yellow, loose sand that has very thin lamellae of strong brown loamy sand. The substratum to a depth of about 60 inches is yellowish brown sand that has thin lamellae of strong brown loamy sand. In some places the total thickness of the lamellae is more than 6 inches. In other places, the soil has no lamellae within 60 inches of the surface.

Permeability is moderately rapid in the upper part of the Oshtemo soil and rapid in the lower part. It is rapid in the Coloma soil. Available water capacity is moderate in the Oshtemo soil and low in the Coloma soil. Surface runoff is rapid on the Oshtemo soil and medium on the Coloma soil.

Most areas are wooded. A few areas are used for pasture or specialty crops. These soils are generally unsuitable as cropland because of the slope and the droughtiness. Specialty crops, such as apples, cherries, and grapes, can be grown.

These soils are poorly suited to pasture. The major management concerns are erosion and droughtiness. Pasture rotation, deferment of grazing during dry periods, and strip grazing help to control erosion and maintain the plant cover. An adequate plant cover reduces the runoff rate and increases the rate of water infiltration. As a result, it helps to overcome the droughtiness.

These soils are fairly well suited to woodland. The major management concern is a high seedling mortality rate. Special planting stock and overstocking may be necessary to compensate for seedling losses.

These soils are poorly suited to building site development and septic tank absorption fields and are generally unsuited to sewage lagoons. The slope of both soils and a poor filtering capacity in the Coloma soil are the major limitations. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in most areas. The distribution lines in septic tank absorption fields should be installed on the contour. The Coloma soil readily absorbs but does not adequately filter septic tank effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is VIe. The Michigan soil management groups are 3a and 5a.

6E—Oshtemo-Coloma loamy sands, 18 to 25 percent slopes. These hilly soils are on side slopes and ridges. The Oshtemo soil is well drained, and the Coloma soil is somewhat excessively drained. Areas are irregular in shape and range from 5 to 25 acres in size. They are about 60 percent Oshtemo soil and 40 percent Coloma soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Oshtemo soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsoil is about 31 inches thick. The upper part is dark yellowish brown, friable sandy loam; the next part is strong brown, friable sandy clay loam; and the lower part is strong brown, very friable sandy loam. The substratum to a depth of about 60 inches is light yellowish brown sand that has thin bands of dark yellowish brown loamy sand. In some places the upper part of the subsoil is more sandy. In other places the lower part of the subsoil has more clay.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 5 inches thick. The subsurface layer is yellowish brown sand about 11 inches thick. The subsoil is about 44 inches of brownish yellow, loose sand that has thin bands of strong brown, very friable loamy sand. The substratum to a depth of about 60 inches is light yellowish brown, loose sand. In some places the total thickness of the bands in the subsoil is more than 6 inches. In other places the subsoil has no bands.

Permeability is moderately rapid in the upper part of the Oshtemo soil and rapid in the lower part. It is rapid in the Coloma soil. Available water capacity is moderate in the Oshtemo soil and low in the Coloma soil. Surface runoff is rapid on the Oshtemo soil and medium on the Coloma soil.

Most areas are used as woodland. A few are pastured, and a few are used as building sites. Because of the slope and the droughtiness, these soils are generally unsuitable as cropland. They are poorly suited to pasture. The major concerns in managing pasture are the droughtiness and the erosion hazard caused by the

slope. Pasture rotation and restricted use during dry periods help to maintain the vegetative cover and thus help to control erosion. An adequate plant cover reduces the runoff rate and increases the rate of water infiltration, thus lessening the droughtiness.

These soils are fairly well suited to woodland. The major management concerns are the erosion hazard, the equipment limitation, and seedling mortality. Building logging roads on the contour helps to control erosion and helps to overcome the equipment limitation. Overstocking may be needed to compensate for seedling losses.

These soils are generally unsuited to building site development, septic tank absorption fields, and sewage lagoons because of the slope.

The land capability classification is VIIe. The Michigan soil management groups are 3a and 5a.

7—Glendora sandy loam. This nearly level, very poorly drained soil is on flood plains along rivers and creeks. It is frequently flooded. Areas are generally elongated and range from 3 to more than 200 acres in size.

Typically, the surface layer is black sandy loam about 7 inches thick. The upper part of the substratum is light gray, grayish brown, and white, mottled, loose fine sand. The next part is grayish brown, mottled, loose loamy fine sand. The lower part to a depth of about 60 inches is pale brown and dark gray, mottled, loose fine sand. In places the substratum has a sandy loam layer.

Included with this soil in mapping are some small areas of the very poorly drained Sloan soils and areas of moderately steep or steep soils bordering the uplands. Sloan soils have less sand throughout than the Glendora soil. They are in landscape positions similar to those of Glendora soil. Included soils make up about 10 to 20 percent of the unit.

Permeability is rapid in the Glendora soil. Available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is within a depth of 1 foot during winter and spring.

Most areas are wooded. Some of the acreage is idle land. Because of the wetness and frequent flooding, this soil is generally unsuitable as cropland. It is poorly suited to pasture. The major concerns in managing pasture are wetness and stream pollution. Grazing could result in water pollution unless the access of livestock to streams and rivers is restricted and runoff is diverted.

These soils are poorly suited to woodland because of the equipment limitation, the windthrow hazard, and seedling mortality. Equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Overstocking may be needed to compensate for seedling losses.

Building site development, septic tank absorption fields, and sewage lagoons are not practical uses of this soil because of the frequent flooding and the wetness.

The land capability classification is VIw. The Michigan soil management group is L-4c.

8A—Morocco loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in slight depressions. Areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is yellowish brown and brownish yellow, mottled loose sand about 21 inches thick. The substratum to a depth of about 60 inches is yellowish brown, mottled sand. In some places the subsoil is more gray. In other places it has loamy sand and sandy loam bands.

Permeability is rapid in the Morocco soil. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet in winter and spring.

Most of the acreage of this soil is idle land. Some areas are used as woodland or pasture. A few are used for specialty crops, such as blueberries and strawberries.

This soil is fairly well suited to such crops as blueberries and strawberries but is poorly suited to corn and wheat. The major management concerns are excess water, soil blowing, and midsummer droughtiness. Surface drains and subsurface tile reduce the wetness. Field windbreaks, wind stripcropping, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control soil blowing. Returning crops residue to the soil and plowing green manure crops under reduce the droughtiness.

Because of the wetness, this soil is only fairly well suited to pasture. The major management concern is the wetness. Grazing during wet periods can result in poor tilth. Restricted grazing during wet periods helps to prevent deterioration of tilth.

This soil is fairly well suited to woodland. The major management concern is the equipment limitation. Equipment should be used only when the soil is relatively dry or frozen.

Because of the wetness, this soil is poorly suited to building site development. It is generally unsuited to sewage lagoons. It is poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. A surface drainage system or subsurface tile helps to lower the water table on building sites. The buildings can be constructed on well compacted fill material, which raises the site. The soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Special construction methods, such as filling or

mounding with less porous material, may be needed to raise the absorption field above the water table.

The land capability classification is IVs. The Michigan soil management group is 5b.

9B—Plainfield sand, 0 to 6 percent slopes. This nearly level and undulating, excessively drained soil is on flats and small ridges in the uplands. Areas are irregular in shape and range from 3 to 600 acres in size.

Typically, the surface layer is dark brown sand about 9 inches thick. The subsoil is dark yellowish brown, loose sand about 11 inches thick. The substratum to a depth of about 60 inches is yellowish brown and brownish yellow sand. In some areas the subsoil has thin bands of loamy sand. In other areas it has bright colored mottles.

Permeability is rapid. Available water capacity is low. Surface runoff is slow.

Most of the acreage of this soil is idle land. Some areas are used as woodland or cropland.

Because of droughtiness, this soil is poorly suited to corn, winter wheat, and rye. Grapes and asparagus generally can make good use of the limited amount of available water in the soil. If these crops are grown, the major management concerns are controlling soil blowing, conserving moisture, and increasing the organic matter content. Field windbreaks, wind stripcropping, vegetative barriers, and cover crops help to control soil blowing. Properly managing crop residue, applying livestock manure, and growing green manure crops increase the organic matter content and the available water capacity.

Because of the droughtiness, this soil is poorly suited to pasture. Applying livestock manure and plowing green manure crops under increase the organic matter content and thus the moisture supply.

This soil is fairly well suited to woodland. Seedling mortality and the equipment limitation are the major management concerns. Special planting stock and overstocking may be necessary to compensate for seedling losses. Carefully selecting sites for logging roads, using wide-tracked equipment, and limiting the use of this equipment to periods when the soil is frozen or moist help to overcome the equipment limitation.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields and sewage lagoons, however, because it readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IVs. The Michigan soil management group is 5.3a.

9C—Plainfield sand, 6 to 12 percent slopes. This gently rolling, excessively drained soil is on knolls and ridges. Areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark brown sand about 9 inches thick. The subsoil is yellowish brown and dark yellowish brown, loose sand about 37 inches thick. The substratum to a depth of about 60 inches is brownish yellow sand. In some areas the subsoil has thin bands of loamy sand.

Permeability is rapid. Available water capacity is low. Surface runoff is slow or medium.

Most of the acreage is idle land. Some areas are used as woodland. This soil is unsuited to most crops because of the hazard of soil blowing, droughtiness, and the low organic matter content. Grapes can be grown if the soil is irrigated.

This soil is poorly suited to pasture. Droughtiness and erosion are the major management concerns. Overgrazing can reduce the extent of the plant cover. Rotation or strip grazing and restricted used during the dry summer months help to prevent excessive erosion. Adding animal manure and incorporating green manure crops into the soil increase the organic matter content and thus the moisture supply.

This soil is fairly well suited to woodland. Seedling mortality and the equipment limitation are the major management concerns. Special planting stock or overstocking may be necessary to compensate for the expected seedling losses. Carefully selecting logging roads, using wide-tracked equipment, and limiting the use of this equipment to periods when the soil is frozen or moist help to overcome the equipment limitation.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields and sewage lagoons because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is VIs. The Michigan soil management group is 5.3a.

10—Aquents and Histosols, ponded. These nearly level, very poorly drained soils are along river tributaries, on the margins of lakes, and in depressions. They are ponded throughout most of the year (fig. 6). Areas range from 3 to 600 acres in size. They are 60 to 70 percent Aquents and 30 to 40 percent Histosols.

Figure 6.—A wooded area of Aquents and Histosols, ponded.

Typically, the Aquents have a black, loamy surface layer about 10 inches thick. The substratum to a depth of about 60 inches is gray loam. In places the soils have a sandy subsoil.

Typically, the upper part of the Histosols is black muck 16 to 51 inches thick. The substratum to a depth of about 60 inches is gray sandy loam and loam.

Most areas support cattails, reeds, and water-tolerant grasses and shrubs. Clumps of trees, many of them dead, are common in most areas. These soils have good potential for wetland wildlife habitat. They are generally unsuitable for cultivated crops, pasture and hay, woodland, and most engineering uses.

The land capability classification is VIIIw. No Michigan soil management group is assigned.

11—Edwards muck. This nearly level, very poorly drained soil is in depressions. It is frequently ponded. Areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the upper 10 inches is black muck. The next 38 inches is black and very dark grayish brown, friable muck. The substratum to a depth of about 60 inches is light gray marl. In places mineral material underlies the marl. This material is below a depth of 24 inches. In some areas the organic material is more than 51 inches thick. In other areas loamy material is below the layers of muck.

Permeability is moderately slow to moderately rapid in the organic material. Available water capacity is high. Runoff is very slow or ponded. The seasonal high water table is at or above the surface in winter and spring.

Most areas of this soil support native vegetation, including trees. A few areas are used for unimproved pasture or for crops.

This soil is poorly suited to cultivated crops. If drained, it can be used for such crops as corn, celery, and

onions. The major management concerns are soil blowing and excess water. Field windbreaks and cover crops help to control soil blowing. A surface drainage system or subsurface tile is needed to reduce the wetness and control the ponding. Lift pumps are needed at the drainage outlets in some areas.

This soil is poorly suited to pasture. The major management concerns are wetness and compaction. Deferment of grazing during the wetter periods can help to keep the pasture in good condition. Small surface ditches can reduce the wetness.

This soil is poorly suited to woodland. The major management concerns are the windthrow hazard, seedling mortality, and the equipment limitation. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only when the soil is frozen. Because of the wetness and the ponding, establishing planting stock is difficult.

Because of the ponding and the excess humus, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IVw. The Michigan soil management group is M/Mc.

12B—Spinks-Oshtemo complex, 0 to 6 percent slopes. These nearly level and undulating, well drained soils are on low knolls and ridges. Areas are irregular in shape and range from 5 to 300 acres in size. They are about 60 percent Spinks soil and 40 percent Oshtemo soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 9 inches thick. The subsurface layer is dark yellowish brown and yellowish loamy sand about 21 inches thick. The subsoil to a depth of about 60 inches is light yellowish brown, loose sand that has bands of dark brown, very friable loamy sand. In places the total thickness of the bands in the subsoil is less than 6 inches.

Typically, the Oshtemo soil has a surface layer of dark brown sandy loam about 11 inches thick. The subsurface layer is yellowish brown loamy sand about 8 inches thick. The subsoil is strong brown, very friable and friable sandy loam about 23 inches thick. The substratum to a depth of about 60 inches is brownish yellow gravelly sand. In places the upper part of the subsoil is more sandy.

Permeability is moderately rapid in the Spinks soil. It is moderately rapid in the upper part of the Oshtemo soil and rapid in the lower part. Available water capacity is low in the Spinks soil and moderate in the Oshtemo soil. Surface runoff is slow on both soils.

Most areas of these soils are used as cropland. Some are used as woodland.

These soils are fairly well suited to corn, soybeans, asparagus, cherries, apples, strawberries, and grapes. The major management concerns are droughtiness, the organic matter content, and soil blowing. Returning crop residue to the soil and growing cover crops help to control droughtiness and soil blowing and increase the organic matter content. Irrigation may be needed in the areas used for corn, cherries, apples, or grapes.

Because of the droughtiness, these soils are only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil increases the moisture supply.

These soils are fairly well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing on the contour or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

These soils are well suited to building site development and septic tank absorption fields. They are poorly suited to sewage lagoons because of seepage. The lagoons should be lined with impervious material.

The land capability classification is IIIs. The Michigan soil management groups are 4a and 3a.

12C—Spinks-Oshtemo complex, 6 to 12 percent slopes. These gently rolling, well drained soils are on knolls and ridges. Areas are irregular in shape and range from 7 to 50 acres in size. They are about 60 percent Spinks soil and 40 percent Oshtemo soil. These two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 6 inches thick. The subsurface layer is dark yellowish brown loamy sand about 9 inches thick. The upper part of the subsoil is yellowish brown, loose sand. The lower part to a depth of about 60 inches is light yellowish brown, loose sand that has bands of dark brown, very friable loamy sand. In some places the total thickness of the bands in the subsoil is less than 6 inches. In other places the lower part of the subsoil is loamy.

Typically, the Oshtemo soil has a surface layer of dark brown sandy loam about 9 inches thick. The subsurface layer is yellowish brown loamy sand about 8 inches thick. The subsoil is strong brown, friable and very friable sandy loam about 25 inches thick. The substratum to a depth of about 60 inches is brownish yellow sand. In some places the surface layer is loamy sand. In other places the slope is less than 6 percent.

Permeability is moderately rapid in the Spinks soil. It is moderately rapid in the upper part of the Oshtemo soil and rapid in the lower part. Available water capacity is low in the Spinks soil and is moderate in the Oshtemo soil. Surface runoff is slow or medium on both soils.

Most areas of these soils are used as cropland. Some are used as woodland.

These soils are fairly well suited to corn, soybeans, cherries, apples, and grapes. The major management

concerns are soil blowing, water erosion, droughtiness, and the organic matter content. Returning crop residue to the soil and growing cover crops help to control soil blowing and water erosion and increase the organic matter content (fig. 7). Irrigation may be needed in the areas used for corn, cherries, apples, or grapes.

Because of the hazard of erosion and the droughtiness, these soil are only fairly well suited to pasture. Overgrazing during dry periods can destroy the plant cover. Rotation grazing and deferment of grazing during dry periods help to prevent excessive erosion. Incorporating animal manure and green cover crops into the soil increases the moisture supply.

These soils are well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing on the contour or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

Because of the slope, these soils are only fairly well suited to building site development and septic tank absorption fields. They are generally unsuited to sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The Michigan soil management groups are 3a and 4a.

17A—Brems sand, 0 to 2 percent slopes. This nearly level, moderately well drained soil is in low depressions. Areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is dark brown sand about 10 inches thick. The subsoil is about 50 inches thick. The upper part is dark yellowish brown, loose loamy sand; the next part is yellowish brown, mottled, loose sand; and the lower part is brownish yellow, mottled, loose sand. In some areas the subsoil has bands of loamy sand. In other areas it has no mottles.

Figure 7.—A cover crop of rye in a vineyard on the Spinks-Oshtemo complex, 6 to 12 percent slopes.

Permeability is rapid. Available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2 to 3 feet in winter and spring.

Most areas of this soil are farmed. Some are used as woodland.

This soil is poorly suited to corn, small grain, soybeans, and hay but is fairly well suited to specialty crops, such as strawberries and blueberries. The major management concerns are the organic matter content, soil blowing, and droughtiness. The content of organic matter can be maintained or increased by adding crop residue, animal manure, and green manure to the soil. Cover crops, wind stripcropping, vegetative barriers, field windbreaks, and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing. Irrigation may be needed in the areas used for corn or specialty crops.

Because of the droughtiness, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil increases the moisture supply.

This soil is well suited to woodland. Seedling mortality is the major management concern. Overstocking helps to compensate for expected seedling losses.

Because of the wetness, this soil is poorly suited to building site development. Buildings with basements should be constructed on well compacted fill material, which raises the site. A drainage system reduces the wetness.

This soil is poorly suited to septic tank absorption fields and is generally unsuited to sewage lagoons. The wetness and a poor filtering capacity are the major limitations. Special construction methods, such as filling or mounding with suitable soil material, may be needed to raise septic tank absorption fields above the water table. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IVs. The Michigan soil management group is 5b.

18B—Ormas loamy sand, 0 to 6 percent slopes. This nearly level and undulating, well drained soil is on flats and small ridges in the uplands. Areas are irregular in shape and range from 7 to 160 acres in size.

Typically, the surface layer is dark brown loamy sand about 6 inches thick. The subsurface layer is about 34 inches thick. The upper part is yellowish brown, loose loamy sand, and the lower part is brownish yellow, loose sand. The subsoil is gravelly sandy loam about 15 inches thick. The upper part is dark brown and very friable, and the lower part is strong brown and friable. The substratum to a depth of about 60 inches is light yellowish brown gravelly sand. In places the subsoil is banded.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are farmed. Some are used as woodland.

This soil is fairly well suited to corn, asparagus, cherries, apples, strawberries, and grapes. The major management concerns are soil blowing, droughtiness, and the organic matter content. Field windbreaks, wind stripcropping, cover crops, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control soil blowing. Returning crop residue to the soil and growing green manure crops increase the organic matter content and conserve moisture. Irrigation may be needed in the areas used for corn, cherries, apples, strawberries, or grapes.

This soil is well suited to pasture. The major management concern is the droughtiness. Incorporating animal manure and green manure crops into the soil increases the moisture supply.

This soil is well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

This soil is well suited to building site development and septic tank absorption fields. It is poorly suited to sewage lagoons. Seepage is the major management concern. It can result in the pollution of ground water. Lining the lagoon with impervious material helps to prevent seepage.

The land capability classification is IIIs. The Michigan soil management group is 4a.

18C—Ormas loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on the uneven side slopes of ridges and knolls. Areas are irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is dark brown loamy sand about 6 inches thick. The subsurface layer is about 34 inches thick. The upper part is yellowish brown, loose loamy sand, and the lower part is brownish yellow, loose sand. The subsoil is gravelly sandy loam about 15 inches thick. The upper part is dark brown and strong brown, and the lower part is strong brown. The substratum to a depth of about 60 inches is light yellowish brown, loose gravelly sand. In places the subsoil is banded.

Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are farmed. Some are used as woodland.

This soil is fairly well suited to corn, asparagus, cherries, apples, and grapes. The major management concerns are water erosion, soil blowing, droughtiness,

and the organic matter content. Field windbreaks, wind stripcropping, cover crops, diversions, grassed waterways, and a system of conservation tillage that does not invert the soil and that leaves all or part of the residue on the surface help to prevent excessive soil loss. Incorporating crop residue and green manure crops into the soil increases the organic matter content and conserves moisture. Irrigation may be needed in the areas used for corn, cherries, apples, or grapes.

This soil is well suited to pasture. The major management concerns are droughtiness and erosion. Incorporating animal manure and green manure crops into the soil increases the moisture supply. Rotation or strip grazing helps to maintain the plant cover and thus helps to control erosion.

This soil is well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing on the contour or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

Because of the slope, this soil is only fairly well suited to building site development and septic tank absorption fields. It is generally unsuited to sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIs. The Michigan soil management group is 4/2a.

19A—Ottokee loamy fine sand, 0 to 3 percent slopes. This nearly level, moderately well drained soil is in low depressions. Areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is dark brown loamy fine sand about 10 inches thick. The subsoil extends to a depth of about 60 inches or more. In sequence downward, it is yellowish brown, loose loamy fine sand; brownish yellow, mottled, loose fine sand; very pale brown, mottled, loose fine sand; and pale brown, mottled, loose fine sand that has thin lamellae of strong brown loamy fine sand. In some areas the subsoil has no lamellae.

Permeability is rapid. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth 2.0 to 3.5 feet in winter and spring.

Most areas of this soil are farmed. Some are used as woodland.

This soil is fairly well suited to corn, strawberries, and blueberries. The major management concerns are the organic matter content, soil blowing, and droughtiness. Returning crop residue to the soil, adding manure, and growing green manure crops increase the organic matter content. Field windbreaks, cover crops, and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface conserve moisture and help to prevent excessive soil blowing. Irrigation can increase productivity.

Because of the droughtiness, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil increases the moisture supply.

This soil is well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

Because of the wetness, this soil is poorly suited to building site development. Buildings with basements should be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table.

Because of the wetness and a poor filtering capacity, this soil is poorly suited to septic tank absorption fields and is generally unsuited to sewage lagoons. Special construction methods, such as filling or mounding, may be needed to raise septic tank absorption fields above the water table. The soil readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIIs. The Michigan soil management group is 4a.

20B—Spinks loamy sand, 0 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on flats and small ridges in the uplands. Areas are irregular in shape and range from 3 to 300 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is about 21 inches thick. It is dark yellowish brown loamy sand in the upper part and yellowish brown sand in the lower part. The subsoil to a depth of about 60 inches is light yellowish brown, loose sand that has thin bands of dark brown, very friable loamy sand. In some places the total thickness of the bands is less than 6 inches. In other places the subsoil has no bands. In some areas it has more clay.

Permeability is moderately rapid. Available water capacity is low. Surface runoff is slow.

Most areas of this soil are farmed. Some of the acreage is idle land or woodland.

This soil is fairly well suited to corn, soybeans, cherries, apples, asparagus, strawberries, and grapes. The major management concerns are droughtiness, the organic matter content, and soil blowing. Field windbreaks, stripcropping, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control soil blowing. Incorporating crop residue and green manure crops into the soil increases the organic matter

content and conserves moisture. Irrigation may be needed in the areas used for corn, cherries, apples, strawberries, or grapes.

Because of the droughtiness, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil increases the moisture supply.

This soil is well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

This soil is well suited to building site development and septic tank absorption fields. It is poorly suited to sewage lagoons because of seepage. Lining the lagoon with impervious material helps to prevent seepage.

The land capability classification is IIIs. The Michigan soil management group is 4a.

20C—Spinks loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on the uneven side slopes of ridges and knolls. Areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark yellowish brown loamy sand about 7 inches thick. The subsurface layer is yellowish brown loamy sand about 10 inches thick. The subsoil is about 43 inches of brownish yellow and yellowish brown sand that has thin bands of strong brown, very friable loamy sand. In places the total thickness of the bands is less than 6 inches.

Permeability is moderately rapid. Available water capacity is low. Surface runoff is slow.

Most areas of this soil are farmed. Some of the acreage is idle land or woodland.

This soil is fairly well suited to corn, cherries, apples, and grapes. The major management concerns are water erosion, soil blowing, droughtiness, and the organic matter content. Field windbreaks, cover crops, and a system of conservation tillage that does not invert the soil help to prevent excessive soil loss. Returning crop residue to the soil and growing green manure crops increase the organic matter content, conserve moisture, and help to control soil blowing. Irrigation can increase productivity.

Because of the droughtiness and the hazard of erosion, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil increase the moisture supply. Overgrazing can reduce the extent of the plant cover. Rotation or strip grazing helps to maintain the plant cover and thus helps to control erosion.

This soil is well suited to woodland. The major management concern is seedling mortality. The seedling survival rate can be increased by special site preparation, such as furrowing or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized.

Because of the slope, this soil is only fairly well suited to building site development and septic tank absorption fields. It is generally unsuited to sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The Michigan soil management group is 4a.

22A—Kalamazoo loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad upland flats. Areas are irregular in shape and range from 20 to 300 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is about 37 inches thick. In sequence downward, it is brown, very friable sandy loam; brown, friable sandy clay loam; brown, very friable sandy loam; strong brown, very friable gravelly sandy loam; and strong brown, loose gravelly sand. The substratum to a depth of about 60 inches is strong brown gravelly sand. In places the subsoil has less clay.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. Some are used as woodland.

This soil is well suited to corn and soybeans. The major management concern is droughtiness. A system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface conserves moisture. Irrigation may be needed when soil moisture levels are low.

This soil is well suited to pasture, woodland, and building site development. No major hazards or limitations affect these uses.

Because of a poor filtering capacity, this soil is only fairly well suited to septic tank absorption fields and is poorly suited to sewage lagoons. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Lining sewage lagoons with impervious material helps to prevent seepage.

The land capability classification is IIs. The Michigan soil management group is 3/5a.

22B—Kalamazoo loam, 2 to 6 percent slopes. This undulating, well drained soil is on low knolls and ridges. Areas are irregular in shape and range from 4 to 320 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 27 inches thick. The upper part is brown, friable sandy clay

loam; the next part is brown, very friable sandy loam; and the lower part is strong brown, very friable sandy loam. The substratum to a depth of about 60 inches is strong brown, loose gravelly sand. In places the subsoil has less clay.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. Some are used as woodland.

This soil is well suited to corn, soybeans, apples, and grapes. The major management concerns are water erosion and droughtiness. Stripcropping, cover crops, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control erosion. Irrigation may be needed in the areas used for corn, apples, or grapes. Regulating the rate of water application and seeding equipment lanes help to control erosion.

This soil is well suited to woodland, pasture, and building site development. No major hazards or limitations affect these uses.

Because of a poor filtering capacity, this soil is only fairly well suited to septic tank absorption fields and is poorly suited to sewage lagoons. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Lining sewage lagoons with impervious material helps to prevent seepage.

The land capability classification is IIe. The Michigan soil management group is 3/5a.

22C—Kalamazoo loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on ridges and the sides of knolls in the uplands. Areas are irregular in shape and range from 4 to 110 acres in size.

Typically, the surface layer is dark brown loam about 10 inches thick. The subsoil is about 46 inches thick. In sequence downward, it is dark yellowish brown, friable sandy clay loam; brown and dark yellowish brown, firm clay loam; yellowish brown, friable sandy clay loam; and strong brown, friable sandy loam. The substratum to a depth of about 60 inches is brownish yellow, stratified sand and gravelly sand. In places the subsoil has less clay.

Permeability is moderate in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is rapid.

Most areas of this soil are used as cropland. Some are used as woodland.

This soil is fairly well suited to corn, soybeans, apples, and grapes. The major management concern is water erosion. Stripcropping, cover crops, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control water erosion. Irrigation may be needed in the areas used for corn, apples, or grapes. If the soil is irrigated, the water application rate should be carefully regulated.

This soil is well suited to woodland and pasture. No major hazards or limitations affect these uses.

This soil is fairly well suited to building site development and septic tank absorption fields and is generally unsuited to sewage lagoons. The slope is a limitation on sites for buildings. The slope and a poor filtering capacity are limitations on sites for septic tank absorption fields and sewage lagoons. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is IIIe. The Michigan soil management group is 3/5a.

24A—Bronson sandy loam, 0 to 3 percent slopes. This nearly level, moderately well drained soil is on flats and in slight depressions. Areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 47 inches thick. The upper part is yellowish brown and strong brown, friable sandy loam; the next part is strong brown, friable sandy clay loam; and the lower part is yellowish brown, mottled, very friable loamy sand. The substratum to a depth of about 60 inches is pale brown sand. In some places the subsoil has less clay. In other places it has more clay. In some areas the upper part of the subsoil is mottled.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is 2.0 to 3.5 feet below the surface from November through May.

Most areas of this soil are used as cropland. A few are used as woodland.

This soil is well suited to corn, soybeans, strawberries, and asparagus. The major management concerns are soil blowing, droughtiness, and a low organic matter content. Cover crops help to control soil blowing, reduce the droughtiness, and increase the organic matter content. A system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to control soil blowing and conserves moisture. Irrigation may be needed in the areas used for corn or strawberries.

This is well suited to pasture. The major management concern is the droughtiness. Incorporating animal manure and green manure crops into the soil reduces the droughtiness.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the wetness, this soil is only fairly well suited to building site development and is poorly suited to septic tank absorption fields. It is generally unsuited to sewage lagoons because of the moderately rapid permeability. Buildings with basements should be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table.

The land capability classification is IIs. The Michigan soil management group is 3a.

26—Gilford sandy loam. This nearly level, very poorly drained soil is in depressional areas and drainageways that are subject to ponding. Areas are irregular in shape and range from 5 to 320 acres in size.

Typically, the surface layer is black sandy loam about 14 inches thick. The subsoil is about 21 inches thick. The upper part is very dark grayish brown and light brownish gray, friable sandy loam; the next part is grayish brown, friable loamy sand; and the lower part is very dark grayish brown, mottled, firm sandy clay loam. The substratum to a depth of about 60 inches is dark grayish brown loamy sand and grayish brown loamy fine sand. In some places the subsoil has less clay. In other places it has more clay.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in winter and spring.

Most areas are wooded. A few are drained and are used for corn, soybeans, or blueberries. This soil is generally unsuitable for cultivated crops because of the wetness. Drainage outlets are not available in most areas.

This soil is fairly well suited to pasture. The major management concern is excess water. Restricted grazing during wet periods helps to prevent compaction and keeps the pasture in good condition.

This soil is well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding before planting, reduces the seedling mortality rate in some areas. Carefully thinning the stands or not thinning them at all reduces the windthrow hazard.

Because of the ponding, this soil is generally not suited to building site development, septic tank absorption fields, or sewage lagoons.

The land capability classification is Vw. The Michigan soil management group is 3/5c.

27—Adrian muck. This nearly level, very poorly drained soil is in depressional areas and drainageways. It is frequently ponded. Areas are irregular in shape and range from 2 to 200 acres in size.

Typically, the surface tier is black muck about 12 inches thick. Below this is black and very dark brown, friable muck about 24 inches thick. The substratum to a depth of about 60 inches is dark gray sand. In some places the muck layer is 8 to 15 inches thick. In other places it is more than 51 inches thick. In some areas the substratum is sandy loam.

Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from November through May.

Most areas of this soil are used as cropland. Some of the acreage is woodland or idle land.

This soil is poorly suited to cropland, but corn, carrots, radishes, and blueberries can be grown. The major management concerns are wetness and soil blowing. Open ditches and subsurface tile can reduce the wetness. In some areas, however, drainage outlets are not readily available. Establishing windbreaks, planting cover crops, and returning crop residue to the soil help to control soil blowing.

This soil is poorly suited to pasture. The major management concerns are wetness and compaction. Small surface ditches can reduce the wetness. Deferment of grazing during wet periods helps to prevent compaction and helps to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. The use of special equipment that does not damage surface root systems and harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Because of the wetness and the ponding, establishing planting stock is difficult.

Because of the ponding, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IVw. The Michigan soil management group is M/4c.

28—Houghton muck. This nearly level, very poorly drained soil is in low areas along drainageways and in depressions. It is frequently ponded. Areas are irregular in shape and range from 3 to 350 acres in size.

Typically, the surface tier is black muck about 18 inches thick. Below this to a depth of about 60 inches is black, friable muck. In places sandy or loamy deposits are within a depth of 51 inches.

Permeability is moderately slow to moderately rapid. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from September through June.

Most areas of this soil are farmed. Some are wooded.

If drained, this soil is fairly well suited to corn, radishes, carrots, and blueberries. The major management concerns are soil blowing and excess water. Field windbreaks, cover crops, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control soil blowing. A surface drainage system and subsurface tile are needed to reduce the wetness. Lift pumps may be needed at the drainage outlet in some areas.

This soil is poorly suited to pasture. The major management concerns are wetness and compaction. Small surface ditches can reduce the wetness. Deferment of grazing during wet periods helps to prevent compaction and helps to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. The use of special equipment that does not damage surface root systems and harvest methods that do no isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Because of the wetness and the ponding, establishing planting stock is difficult.

Because of the ponding and the excess humus, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IIIw. The Michigan soil management group is Mc.

32—Colwood silt loam. This nearly level, poorly drained soil is in depressional areas, in natural drainageways, and on broad flats. It is frequently ponded. Areas are irregular in shape and range from 3 to more than 120 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil is about 21 inches thick. In sequence downward, it is grayish brown, firm clay loam; light brownish gray, firm silty clay loam; light olive gray, firm, stratified silty clay loam and silt loam; and gray, firm silt loam. The substratum to a depth of about 60 inches is light brownish gray, gray, and grayish brown, stratified fine sandy loam, silt loam, and silty clay loam. In places the subsoil is sandy.

Included with this soil in mapping are some small areas of the somewhat poorly drained Capac soils on small knolls. These soils make up about 5 percent of the unit.

Permeability is moderate in the Colwood soil. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from October through May.

Most areas of this soil are farmed. A few are used as woodland.

If drained, this soil is well suited to corn and soybeans. The major management concern is excess water. A surface drainage system and subsurface tile are needed to reduce the wetness. Suitable filtering material is needed to keep subsurface tile lines from becoming clogged with fine sand, silt, and clay.

This soil is fairly well suited to pasture. The major management concerns are excess water and deterioration of tilth. Grazing when the soil is wet can cause surface compaction and poor tilth. Restricted or deferred grazing during wet periods helps to maintain good tilth.

This soil is fairly well suited to woodland. The major management concerns are seedling mortality, the windthrow hazard, and the equipment limitation. Special planting stock and overstocking reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen.

Because of the ponding, this soil is generally not suited to building site development, septic tank absorption fields, or sewage lagoons.

The land capability classification is IIw. The Michigan soil management group is 2.5c-s.

33B—Tuscola silt loam, 0 to 4 percent slopes. This nearly level and undulating, moderately well drained soil is on convex slopes and in concave areas along drainageways. Areas are irregular in shape and range from 3 to 45 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is yellowish brown, firm silt loam about 5 inches thick. The subsoil is about 16 inches thick. It is dark brown and dark yellowish brown, mottled, firm silty clay loam. The substratum to a depth of about 60 inches is brown, mottled, very firm, stratified silty clay loam and silt loam. In some places the subsoil has no mottles. In other places it has grayish mottles in the upper part.

Permeability is moderate. Available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet from November through April.

Most areas of this soil are farmed. A small acreage is idle land or woodland.

This soil is well suited to corn, wheat, soybeans, and specialty crops, such as apples. The major management needs are measures that help to control water erosion and maintain good tilth. An example is a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface. Good tilth also can be maintained by restricting fieldwork during wet periods.

This soil is well suited to pasture. The major management concern is maintaining good tilth. Grazing after heavy rains usually results in surface compaction

and excessive runoff. Rotation or strip grazing and timely deferment of grazing help to maintain good tilth.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

Because of the wetness, this soil is poorly suited to building site development, septic tank absorption fields, and sewage lagoons. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Special construction methods, such as mounding with suitable material, may be needed to raise septic tank absorption fields above the water table. Lining sewage lagoons with impervious material helps to prevent seepage.

The land capability classification is IIe. The Michigan soil management group is 2.5a-s.

36C—Oakville fine sand, 2 to 12 percent slopes. This undulating and gently rolling, well drained soil is on ridges. Areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is very dark brown fine sand about 10 inches thick. The subsoil is yellowish brown, loose fine sand about 14 inches thick. The substratum to a depth of about 60 inches is very pale brown fine sand. In some small areas thin bands of loamy fine sand are in the subsoil. In other small areas the substratum is mottled. In places the subsoil is sand.

Permeability is rapid. Available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. Some of the acreage is used as recreation areas. Because of droughtiness, the hazard of soil blowing, and the slope, this soil is generally unsuited to cropland. It is fairly well suited to some recreation uses. The major management concerns are the slope; the soft, loose, sandy surface layer; and the hazard of erosion. Paths, trails, and picnic areas can be designed so that they conform to the natural slope of the land. Covering paths and trails with wood chips and bark improves trafficability and helps to control erosion. The plant cover is generally too sparse to withstand heavy foot traffic. Adding loamy material to the surface and seeding drought-resistant grasses and legumes improve picnic areas. Camping areas can be established on the less sloping parts of the landscape.

This soil is well suited to woodland. The major management concerns are seedling mortality and the equipment limitation. The seedling survival rate can be increased by special site preparation, such as furrowing on the contour or applying herbicide before planting, and by selection of planting stock that is more than 2 years old or is containerized. Carefully selecting sites for logging roads, using wide-tracked equipment, and limiting the use of this equipment to periods when the soil is frozen or moist help to overcome the equipment limitation.

Because of the slope, this soil is only fairly well suited to building site development. It is only fairly well suited to septic tank absorption fields because of the slope and a poor filtering capacity. It is generally unsuited to sewage lagoons because of the slope and seepage. It readily absorbs but does not adequately filter the effluent from septic tanks. The poor filtering capacity can result in the pollution of ground water supplies. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is VIs. The Michigan soil management group is 5.3a.

36D—Oakville fine sand, 12 to 25 percent slopes. This rolling and hilly, well drained soil is on dunes and beach ridges. Areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is very dark grayish brown fine sand about 4 inches thick. The subsurface layer is brown fine sand about 5 inches thick. The subsoil is yellowish brown and brownish yellow, loose fine sand about 23 inches thick. The substratum to a depth of about 60 inches is very pale brown fine sand. In places the soil is sand throughout. In some small areas thin bands of loamy fine sand are in the subsoil. In other small areas the subsoil is sand. In some areas the slope is less than 12 percent.

Permeability is rapid. Available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. Some of the acreage is used as recreation areas. This soil is generally unsuited to cropland, building site development, septic tank absorption fields, and sewage lagoons because of the slope.

This soil is well suited to woodland. The major management concerns are the erosion hazard, the equipment limitation, and seedling mortality. Because of the erosion hazard, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Furrowing on the contour or applying herbicide reduces the seedling mortality rate and helps to control erosion. Selection of planting stock that is more than 2 years old or is containerized increases the seedling survival rate. Carefully selecting sites for logging roads, using wide-tracked equipment, and limiting the use of this equipment to periods when the soil is frozen or moist help to overcome the equipment limitation. Caution is needed if the equipment is operated on the steeper slopes.

This soil is fairly well suited to some recreation uses. The major management concerns are the slope; the soft, loose, sandy surface layer; and the hazard of erosion.

Paths and trails can be designed so that they conform to the natural slope of the land. Covering paths and trails with bark and wood chips improves trafficability and helps to control erosion. The plant cover is generally too sparse to withstand heavy foot traffic. Camping areas can be established on the less sloping parts of the landscape.

The land capability classification is VIIs. The Michigan soil management group is 5.3a.

36E—Oakville fine sand, 25 to 60 percent slopes. This steep and very steep, well drained soil is on dunes and beach ridges. Areas are irregular in shape and range from 5 to 500 acres in size.

Typically, the surface layer is very dark grayish brown fine sand about 4 inches thick. The subsurface layer is brown fine sand about 5 inches thick. The subsoil is yellowish brown and brownish yellow, loose fine sand about 23 inches thick. The substratum to a depth of about 60 inches is very pale brown fine sand. In places the soil is sand throughout. In some small areas thin bands of loamy fine sand are in the subsoil. In other small areas the slope is less than 25 percent.

Permeability is rapid. Available water capacity is low. Surface runoff is medium.

Most areas are wooded. Some are mined for sand. This soil is generally unsuited to cropland, building site development, septic tank absorption fields, and sewage lagoons because of the slope.

This soil is well suited to woodland. The major management concerns are the erosion hazard, the equipment limitation, and seedling mortality. Because of the erosion hazard, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Furrowing on the contour or applying herbicide reduces the seedling mortality rate and helps to control erosion. Selection of planting stock that is more than 2 years old or is containerized increases the seedling survival rate. Carefully selecting sites for logging roads, using wide-tracked equipment, and limiting the use of this equipment to periods when the soil is frozen or moist help to overcome the equipment limitation. Caution is needed if the equipment is operated on the steeper slopes.

This soil is poorly suited to most recreation uses. The major management concerns are the slope; the soft, loose, sandy surface layer; and the hazard of erosion. Paths and trails can be designed so that they conform to the natural slope of the land. Covering paths and trails with bark and wood chips improves trafficability and helps to control erosion. The plant cover is generally too sparse to withstand heavy foot traffic.

The land capability classification is VIIs. The Michigan soil management group is 5.3a.

37A—Thetford loamy sand, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in depressions and in concave areas along drainageways. Areas are irregular in shape and range from 3 to 70 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is yellowish brown, mottled loamy sand about 2 inches thick. The subsoil is about 34 inches thick. It is light yellowish brown, mottled, loose sand that has thin strata of yellowish brown, very friable loamy sand. The substratum to a depth of about 60 inches is light yellowish brown, mottled sand. In some small areas the subsoil has no mottles. In places it has more clay.

Permeability is moderately rapid. Available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet in winter and spring.

Most areas of this soil are farmed. Some are used as woodland.

This soil is fairly well suited to corn, soybeans, wheat, and specialty crops, such as blueberries. The wetness is a limitation during some periods, and the droughtiness is a limitation during other periods. Soil blowing is an additional management concern. A surface drainage system and subsurface tile help to remove excess water. Field windbreaks, wind stripcropping, cover crops, and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing. Adding manure and green manure crops increases the moisture supply during dry periods.

This soil is well suited to pasture. No major hazards or limitations affect pastured areas.

This soil is well suited to woodland. The major management concern is the equipment limitation. Equipment should be used only when the soil is relatively dry or frozen.

Because of the wetness, this soil is poorly suited to building site development. It is poorly suited to septic tank absorption fields and sewage lagoons because of the wetness and a poor filtering capacity. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Buildings with basements should be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table. Lining sewage lagoons with an impervious material helps to prevent seepage.

The land capability classification is IIIw. The Michigan soil management group is 4b.

38—Napoleon mucky peat. This nearly level, very poorly drained soil is in closed, deep depressions. It is frequently ponded. When the water table is below the

surface, the higher interior parts of the depressions are surrounded by water. Areas are irregularly shaped or circular and range from 3 to 100 acres in size.

Typically, the surface layer is black mucky peat about 16 inches thick. Below this to a depth of about 60 inches is dark reddish brown mucky peat. In places sandy deposits are within a depth of 51 inches.

Permeability is moderate or moderately rapid. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from September through June.

Most areas are wooded. In some areas wild blueberries are harvested every year. This soil is unsuited to most of the crops commonly grown in the county. Such crops as blueberries can be grown if drainage is adequately controlled.

This soil is moderately well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. Special equipment that does not damage surface root systems and harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Because of the wetness and the ponding, establishing planting stock is difficult.

This soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons because of the ponding.

The land capability classification is VIw. The Michigan soil management group is Mc-a.

39A—Matherton loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in depressions and on low slopes along drainageways. Areas are irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is grayish brown, mottled, firm loam about 4 inches thick. The subsoil is about 12 inches thick. The upper part is brown and yellowish brown, mottled, firm loam, and the lower part is grayish brown, mottled, firm sandy clay loam. The upper part of the substratum is grayish brown, mottled loamy sand. The next part is pale brown sand. The lower part to a depth of about 60 inches is yellowish brown gravelly loamy sand. In some places the subsoil has slightly less clay. In other places the upper part of the subsoil has no mottles.

Permeability is moderate in the upper part of the profile and rapid or very rapid in the lower part. Available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from November through May.

Most areas of this soil are farmed. Some are used as woodland.

This soil is well suited to corn, small grain, and soybeans. The major management concerns are removing excess water and maintaining good tilth. A combination of surface drains and subsurface tile helps to remove the excess water. Good tilth can be maintained by restricting fieldwork during wet periods and by applying a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface.

This soil is well suited to pasture. The major management concerns are removing excess water and maintaining tilth. Grazing after heavy rains usually results in surface compaction and excessive runoff. Rotation or strip grazing and timely deferment of grazing help to maintain good tilth.

This soil is well suited to woodland. The major management concerns are the equipment limitation and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because of the wetness, this soil is poorly suited to building site development. Buildings with basements should be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table. Because of the wetness and a poor filtering capacity, the soil is poorly suited to septic tank absorption fields and is generally unsuited to sewage lagoons. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table.

The land capability classification is IIw. The Michigan soil management group is 3/5b.

43—Sloan loam. This nearly level, very poorly drained soil is on flood plains along rivers and creeks. It is frequently flooded. Areas are elongated or irregularly shaped and range from 3 to 250 acres in size.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsoil is grayish brown and gray, mottled, firm clay loam about 40 inches thick. The substratum to a depth of about 60 inches is gray, mottled, very firm, stratified silt loam and silty clay loam.

Included with this soil in mapping are small areas of the very poorly drained Cohoctah soils and small areas of moderately steep or steep soils bordering the uplands. Cohoctah soils contain less clay than the Sloan soil. They are in landscape positions similar to those of the Sloan soil. Included soils make up about 8 to 15 percent of the unit.

Permeability is moderately slow or moderate in the Sloan soil. Available water capacity is high. Surface runoff is slow or very slow. The seasonal high water table is within a depth of 1 foot in winter and spring.

Most areas are wooded. A few are farmed. This soil is generally unsuited to cropland because of the frequent

flooding and the seasonal high water table. Drainage outlets are not available in most areas.

Because of the flooding and the excess water, this soil is poorly suited to pasture. Grazing can result in water pollution if the livestock have access to streams and rivers. Runoff from the pastured areas also can result in pollution.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate in some areas. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because of the wetness and the flooding, this soil is poorly suited to recreational development. It is not suited to campgrounds or playgrounds because of the flooding. Draining the soil is difficult because of a lack of suitable outlets. Limiting use to the drier periods or filling with suitable material helps to overcome the wetness in picnic areas and on paths and trails.

Building site development, septic tank absorption fields, and sewage lagoons are not practical uses of this soil because of the frequent flooding.

The land capability classification is Vw. The Michigan soil management group is L-2c.

45B—Covert sand, 0 to 4 percent slopes. This nearly level and undulating, moderately well drained soil is in broad areas, on narrow ridgetops, and on low knolls on lake plains. Areas are narrow or irregularly shaped and range from 3 to 600 acres in size.

Typically, the surface layer is very dark grayish brown sand about 8 inches thick. The subsurface layer is light brownish gray sand about 7 inches thick. The subsoil is dark reddish brown and strong brown, loose sand about 20 inches thick. The substratum to a depth of about 60 inches is pale brown, mottled sand. In some places the subsoil is more gray. In other places the soil has no mottles.

Permeability is rapid. Available water capacity is low. Surface runoff is very slow. The seasonal high water table is 2.0 to 3.5 feet below the surface from November through April.

Most of the acreage of this soil is grassland. Some areas are used as woodland.

This soil is poorly suited to most of the crops commonly grown in the county, but it can be used for small grain and alfalfa. Some specialty crops, such as asparagus and blueberries, also can be grown if the soil is irrigated. The major management concerns are soil blowing and droughtiness. Soil blowing can be controlled by wind stripcropping, vegetative barriers, field windbreaks, cover crops, and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface.

Because of the droughtiness, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil conserves moisture.

This soil is well suited to woodland. Seedling mortality and the equipment limitation are the major management concerns. Selecting nursery stock that is more than 2 years old or is containerized, planting in furrows, and applying herbicides increase the seedling survival rate. Using wide-tracked equipment and operating this equipment only during periods when the soil is relatively dry or frozen help to overcome the equipment limitation.

Because of the wetness, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields and generally unsuited to sewage lagoons because of the wetness and a poor filtering capacity. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies. Buildings with basements should be constructed on well compacted fill material, which raises the site. A drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, may be needed to raise septic tank absorption fields above the water table.

The land capability classification is IVs. The Michigan soil management group is 5a.

47A—Selfridge loamy sand, 0 to 3 percent slopes. This nearly level, somewhat poorly drained soil is on slightly convex plains, knolls, and short, uneven side slopes. Areas are irregular in shape and range from 6 to 500 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 12 inches thick. The subsurface layer is yellowish brown and reddish yellow sand about 21 inches thick. The subsoil is about 5 inches thick. It is brown and mottled. The upper part is friable sandy loam, and the lower part is firm clay loam. The substratum to a depth of about 60 inches is brown, mottled, very firm silty clay loam. In some places the upper part of the subsoil has no mottles. In other places the substratum is stratified silt loam and very fine sand. In some areas the depth to the substratum is more than 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac soils. These soils have more clay in the surface soil and subsoil than the Selfridge soil. They are in landscape positions similar to those of Selfridge soil. They make up about 8 percent of the unit.

Permeability is rapid in the upper part of the Selfridge soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet in winter and spring.

Most areas of this soil are farmed. Some are used as woodland.

This soil is fairly well suited to corn and soybeans. The wetness is a limitation during some periods, and droughtiness is a limitation during other periods. Soil blowing is an additional management concern. Subsurface tile drainage is needed. Cover crops and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface help to control soil blowing and increase the available water capacity.

This soil is well suited to pasture. The major management concerns are the wetness in spring and the droughtiness during dry summer months. Incorporating animal manure and green manure crops into the soil conserves moisture during dry periods.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Selecting nursery stock that is more than 2 years old or is containerized, planting in furrows, and applying herbicide increase the seedling survival rate. Special equipment that does not damage surface root systems and harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because of the wetness and the slow permeability, this soil is poorly suited to building site development and septic tank absorption fields. It is poorly suited to sewage lagoons because of the wetness. Buildings can be constructed on well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table. Special construction methods, such as filling or mounding with suitable material, can help to raise septic tank absorption fields above the water table and can help to overcome the restricted permeability.

The land capability classification is IIIw. The Michigan soil management group is 4/2b.

48A—Pipestone-Kingsville complex, 0 to 3 percent slopes. These soils are nearly level. The somewhat poorly drained Pipestone soil is on slight knolls. The very poorly drained Kingsville soil is in depressions or natural drainageways. It is frequently ponded. Areas are irregular in shape and range from 15 to 300 acres in size. They are about 60 percent Pipestone soil and 40 percent Kingsville soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the Pipestone soil has a surface layer of very dark grayish brown fine sand about 9 inches thick. The subsurface layer is grayish brown, mottled fine sand about 5 inches thick. The subsoil is about 12 inches thick. It is mottled. The upper part is dark brown, very friable fine sand; the next part is dark reddish brown, friable fine sand; and the lower part is dark reddish brown, very friable sand. The substratum to a depth of about 60 inches is yellowish brown, mottled fine sand. In places the upper part of the subsoil has no mottles.

Typically, the Kingsville soil has a surface layer of very dark gray loamy sand about 8 inches thick. The subsoil is mottled sand about 22 inches thick. The upper part is dark grayish brown, and the lower part is light brownish gray and loose. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown sand. In places the surface layer is more than 8 inches thick.

Permeability is rapid in both soils. Available water capacity is low. Surface runoff is slow or very slow. The seasonal high water table in the Pipestone soil is at a depth of 0.5 foot to 1.5 feet from October through June. The one in the Kingsville soil is at or above the surface from January through April.

Most areas of these soils are used for specialty crops. A few are used as woodland.

These soils are poorly suited to corn, small grain, and hay. If drained, they are well suited to blueberries. The major management concerns are excess water and soil blowing. Surface drains and subsurface tile help to remove excess water. Cover crops help to control soil blowing.

These soils are poorly suited to pasture. The major management concerns are droughtiness in summer and excess water during other periods. Overgrazing during dry periods can reduce the extent of the plant cover. Rotation grazing during dry periods helps to overcome the droughtiness. Small surface ditches can remove excess water.

These soils are fairly well suited to woodland. The major management concerns are the windthrow hazard, seedling mortality, and the wetness. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Because of the wetness, the seedling mortality rate can be high on the Kingsville soil. Overstocking may be needed to compensate for seedling losses.

Because of the wetness and the ponding, these soils are generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IVw. The Michigan soil management groups are 5b and 5c.

49B—Grattan sand, 0 to 6 percent slopes. This nearly level and undulating, excessively drained soil is on flats and small ridges in the uplands. Areas are irregular in shape and range from 2 to 150 acres in size.

Typically, the surface layer is very dark grayish brown sand about 11 inches thick. The subsurface layer is brown sand about 3 inches thick. The subsoil is dark reddish brown and strong brown, loose sand about 12 inches thick. The substratum to a depth of about 60 inches is very pale brown and light yellowish brown sand. In some areas the subsoil is mottled. In some small areas the soil has no subsurface layer.

Permeability is rapid. Available water capacity is very low. Surface runoff is slow.

Most areas are used as woodland. Some of the acreage is idle grassland. This soil is unsuited to most of the crops commonly grown in the county, but it can be used for asparagus.

Because of droughtiness, this soil is poorly suited to pasture. Overgrazing can reduce the extent of the plant cover. Rotation or strip grazing helps to maintain the plant cover and thus conserves moisture. Field windbreaks increase the moisture supply by trapping snow.

This soil is fairly well suited to woodland. Seedling mortality and the equipment limitation are the major management concerns. When the timber is harvested, some mature trees should be left in the stand to provide the seedlings shade and protection. Special planting stock may be needed to reduce the seedling mortality rate. Carefully selecting sites for logging roads, using wide-tracked equipment, and limiting the use of this equipment to periods when the soil is frozen or moist help to overcome the equipment limitation.

This soil is well suited to building site development. Because of a poor filtering capacity, however, it is poorly suited to septic tank absorption fields and is generally unsuited to sewage lagoons. It readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water supplies.

The land capability classification is VIs. The Michigan soil management group is 5.3a.

50B—Metea loamy fine sand, 1 to 6 percent slopes. This nearly level and undulating, well drained soil is on ridges and knolls. Areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 10 inches thick. The subsurface layer is dark brown and yellowish brown, loose fine sand about 16 inches thick. The subsoil is about 10 inches thick. The upper part is dark brown, friable sandy loam, and the lower part is dark yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is brownish yellow and dark yellowish brown silty clay loam and yellowish brown silt loam. In some places the depth to loamy material is more than 40 inches. In other places the lower part of the subsoil is mottled. In some areas the upper sandy material is slightly less than 20 inches thick.

Included with this soil in mapping are some small areas of the well drained Riddles soils. These soils are in landscape positions similar to those of the Metea soil. They are less droughty than the Metea soil. They make up about 8 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. A few are used as woodland.

This soil is fairly well suited to corn, apples, cherries, strawberries, asparagus, and grapes. The major management concerns are droughtiness, the organic matter content, and soil blowing. Returning crop residue to the soil and growing cover crops conserve moisture and reduce the susceptibility to soil blowing. They also increase the organic matter content. Irrigation may be needed in the areas used for corn, apples, cherries, strawberries, or grapes.

Because of the droughtiness, this soil is only fairly well suited to pasture. Incorporating animal manure and green manure crops into the soil conserves moisture.

This soil is well suited to woodland. The major management concerns are seedling mortality and the equipment limitation. Special planting stock or overstocking may be needed to compensate for seedling losses. Equipment should be used only when the soil is frozen or moist.

This soil is well suited to building site development. It is only fairly well suited to septic tank absorption fields because of the moderate permeability in the lower part of the profile. Enlarging the absorption field helps to overcome this limitation.

The land capability classification is IIIe. The Michigan soil management group is 4/2a.

50C—Metea loamy fine sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on ridges and the sides of knolls. Areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is brown loamy fine sand about 10 inches thick. The subsoil is about 30 inches thick. The upper part is light yellowish brown sand; the next part is dark yellowish brown, friable sandy loam; and the lower part is dark yellowish brown, firm sandy clay loam. The substratum to a depth of about 60 inches is pale brown silt loam. In places the depth to loamy material is more than 40 inches.

Included with this soil in mapping are small areas of the well drained Riddles soils. These soils are in landscape positions similar to those of the Metea soil. They are less droughty than the Metea soil. They make up about 9 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. Available water capacity is moderate. Surface runoff is slow.

Most areas of this soil are used as cropland. Some are used as woodland.

This soil is fairly well suited to corn, cherries, apples, peaches, and grapes. The major management concerns are droughtiness, the organic matter content, water erosion, and soil blowing. Erosion and soil blowing can be controlled by returning crop residue to the soil. Erosion also can be controlled by cover crops, grassed waterways, and diversions. Crop residue management

and cover crops increase the organic matter content and reduce the droughtiness. Irrigation can increase productivity.

Because of the hazard of erosion and the droughtiness, this soil is only fairly well suited to pasture. The growth of pasture plants is retarded during dry periods. Overgrazing during these periods can destroy the plant cover and increase the susceptibility to erosion. Rotation grazing and deferment of grazing during dry periods help to maintain the plant cover and thus help to control erosion. Incorporating animal manure and green manure crops into the soil reduces the droughtiness.

This soil is well suited to woodland. The major management concerns are seedling mortality and the equipment limitation. When the timber is harvested, some mature trees should be left in the stand to provide the seedlings shade and protection. Special planting stock can reduce the seedling mortality rate. Equipment should be used only when the soil is frozen or moist.

This soil is fairly well suited to building site development and septic tank absorption fields. The slope is a limitation. Also, the moderately slow permeability is a limitation on sites for septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Enlarging the absorption field helps to overcome the restricted permeability.

The land capability classification is IIIe. The Michigan soil management group is 4/2a.

51—Kingsville loamy sand. This nearly level, poorly drained soil is in low depressional areas and drainageways. It is frequently ponded. Areas are irregular in shape and range from 7 to 1,000 acres in size.

Typically, the surface layer is very dark gray loamy sand about 8 inches thick. The subsoil is mottled sand about 22 inches thick. The upper part is dark grayish brown and very friable, and the lower part is light brownish gray and loose. The substratum to a depth of about 60 inches is dark grayish brown and grayish brown sand. In some places the subsoil is not so gray. In other places the surface layer and subsoil are sandy loam. In some areas the surface layer is more than 9 inches thick.

Permeability is rapid. Available water capacity is low. Surface runoff is very slow. The seasonal high water table is near or above the surface from January through April.

Most areas of this soil are farmed. The larger areas are used for blueberries (fig. 8). Some areas are used as woodland.

This soil is poorly suited to such crops as corn and small grain but is well suited to such crops as blueberries. The major management concerns are excess water and soil blowing. Surface drains and subsurface tile can reduce the wetness. Green manure crops and field windbreaks help to control soil blowing.

Because of the excess water, this soil is only fairly well suited to pasture. Grazing during wet periods can result in poor tilth. Some ponded areas can be drained by small surface ditches.

This soil is fairly well suited to woodland. The major management concerns are the windthrow hazard, seedling mortality, and the equipment limitation. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Because of the wetness, the seedling mortality rate can be high. Overstocking may be needed to compensate for seedling losses. Equipment should be used only when the soil is relatively dry or frozen.

Because of the ponding, the soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IVw. The Michigan soil management group is 5c.

52B—Riddles sandy loam, 1 to 6 percent slopes. This nearly level and undulating, well drained soil is on ridges and in broad areas on till plains. Areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown, firm clay loam about 9 inches thick. The subsoil is about 28 inches thick. It is dark yellowish brown and firm. The upper part is clay loam, and the lower part is sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown clay loam. In some small areas the subsoil is mottled throughout. In places it is mottled in the lower part.

Included with this soil in mapping are small areas of the well drained Metea soils. These soils are more droughty than the Riddles soil. They are in landscape positions similar to those of the Metea soil. They make up 6 to 9 percent of the unit.

Permeability is moderate in the Riddles soil. Available water capacity is high. Surface runoff is medium.

Most areas of this soil are used as cropland. Some areas are used as woodland.

This soil is well suited to corn, wheat, soybeans, apples (fig. 9), cherries, and peaches. The major management concern is water erosion. Returning crop residue to the soil, planting cover crops, and establishing grassed waterways help to prevent excessive soil loss.

This soil is well suited to pasture and woodland. No major hazards or limitations affect these uses.

This soil is fairly well suited to building site development, septic tank absorption fields, and sewage lagoons. The shrink-swell potential is a limitation on sites for buildings. Replacing the upper layers of the soil with suitable material helps to overcome this limitation. The moderate permeability is a limitation on sites for septic

Figure 8.—An area of Kingsville loamy sand used for blueberries.

tank absorption fields. It can be overcome by enlarging the absorption field. Lining sewage lagoons with impervious material helps to prevent seepage.

The land capability classification is IIe. The Michigan soil management group is 2.5a.

52C—Riddles sandy loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on the sides of ridges and knolls on till plains. Areas are irregular in shape and range from 6 to 20 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown, firm clay loam about 9 inches thick. The subsoil is about 28 inches thick. It is dark yellowish brown and firm. The upper part is clay loam, and the lower part is sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown clay loam. In some places the lower part of the subsoil is mottled. In other places the upper 20 inches is sandy loam.

Included with this soil in mapping are small areas of the well drained Metea soils. These soils are more droughty than the Riddles soil. They are in landscape positions similar to those of the Riddles soil. They make up 6 to 9 percent of the unit.

Permeability is moderate in the Riddles soil. Available water capacity is high. Surface runoff is medium or rapid.

Most areas of this soil are used as cropland. Some are pastured or wooded.

This soil is fairly well suited to corn, wheat, soybeans, apples, and peaches. Water erosion is the major management concern. It can be controlled by returning crop residue to the soil, planting cover crops, establishing grassed waterways, and applying a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface.

Because it is subject to water erosion, this soil is only fairly well suited to pasture. Grazing after heavy rains can result in surface compaction and excessive erosion. Rotation grazing and deferment of grazing during wet periods help to keep the pasture in good condition and reduce the susceptibility to erosion.

This soil is well suited to woodland. No major hazards or limitations affect planting or harvesting.

This soil is fairly well suited to building site development. The slope and the shrink-swell potential are limitations. The buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is needed. Replacing the upper

Figure 9.—Apple trees on Riddles sandy loam, 1 to 6 percent slopes.

layers of the soil with suitable material can help to overcome the shrink-swell potential.

Because of the moderate permeability and the slope, this soil is only fairly well suited to septic tank absorption fields. It is generally unsuited to sewage lagoons because of the slope and seepage. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Enlarging the absorption field helps to overcome the moderate permeability.

The land capability classification is IIIe. The Michigan soil management group is 2.5a.

52D—Riddles sandy loam, 12 to 18 percent slopes. This rolling, well drained soil is on hillsides and ridges. Areas are irregular in shape and range from 10 to 20 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown, firm clay loam about 9 inches thick. The subsoil is about 28 inches thick. It is dark yellowish brown and firm. The upper part is clay loam, and the lower part is sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown clay loam. In some places the subsoil has less clay. In other places the substratum is sand and gravelly sand.

Permeability is moderate. Available water capacity is high. Surface runoff is rapid.

Most areas of this soil are wooded. Some are used as pasture.

This soil is well suited to apples and cherries. It is too steep for intensive cropping. Water erosion is the major management concern. It can be controlled by establishing grassed waterways, terracing, and seeding orchard lanes.

Because it is subject to water erosion, this soil is only fairly well suited to pasture. Maintaining an adequate vegetative cover by rotation grazing helps to control surface runoff and erosion.

This soil is fairly well suited to woodland. The erosion hazard and the equipment limitation are the major management concerns. Logging roads should be built on the contour.

Because of the slope, this soil is poorly suited to building site development and septic tank absorption fields. It is generally unsuited to sewage lagoons because of the slope and seepage. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. The distribution lines in septic tank absorption fields should be installed on the contour.

The land capability classification is IVe. The Michigan soil management group is 2.5a.

52E—Riddles sandy loam, 18 to 25 percent slopes. This hilly, well drained soil is on hillsides and ridges. Areas are irregular in shape and range from 4 to 20 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is brown, firm clay loam about 9 inches thick. The subsoil is about 28 inches thick. It is dark yellowish brown and firm. The upper part is clay loam, and the lower part is sandy clay loam. The substratum to a depth of about 60 inches is dark yellowish brown clay loam. In places the subsoil has less clay.

Permeability is moderate. Available water capacity is high. Surface runoff is rapid.

Most areas are wooded. Some of the acreage is idle grassland. Because it is subject to water erosion, this soil is unsuitable as cropland and is poorly suited to pasture. Maintaining an adequate vegetative cover by rotation grazing helps to control surface runoff and erosion.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation and the erosion hazard. Logging roads should be built on the contour. Water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures.

This soil is generally unsuited to building site development, sewage lagoons, and septic tank absorption fields because of the slope. Overcoming this limitation is extremely difficult.

The land capability classification is VIe. The Michigan soil management group is 2.5a.

53B—Capac loam, 1 to 5 percent slopes. This nearly level and undulating, somewhat poorly drained soil is on slight ridges and in broad areas on till plains. Areas are irregular in shape and range from 3 to 800 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is about 19 inches thick. It is mottled. The upper part is grayish brown, friable loam; the next part is brown, firm clay loam; and the lower part is grayish brown, firm clay loam. The substratum to a depth of about 60 inches is brown, mottled loam. In some places the surface layer and the upper part of the subsoil are sandy loam. In other places the depth to the substratum is less than 27 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Selfridge and poorly drained Colwood soils. Selfridge soils are in landscape positions similar to those of the Capac soil. They have at least 20 inches of sand in the upper part. They make up about 6 percent of the unit. Colwood soils are in depressional areas. They make up about 5 percent of the unit.

Permeability is moderately slow in the Capac soil. Available water capacity is high. Surface runoff is slow or medium. The seasonal high water table is at a depth of 1 to 2 feet from November through May.

Most areas of this soil are used as cropland. Some are wooded.

This soil is well suited to corn, soybeans, apples, and peaches. The major management concerns are controlling water erosion, removing excess water during wet periods, and maintaining good tilth. Cover crops and a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface help to control water erosion. A combination of surface and subsurface drains reduces the wetness. Good tilth can be maintained by restricting fieldwork during wet periods and by applying a system of conservation tillage.

This soil is fairly well suited to pasture. The major management concerns are reducing the wetness and maintaining tilth. Grazing after heavy rains can result in surface compaction and excessive runoff. Rotation grazing and deferment of grazing during wet periods help to maintain tilth. Surface and subsurface drains reduce the wetness.

This soil is well suited to woodland. The equipment limitation and the windthrow hazard are the major management concerns. Equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because of the wetness, this soil is poorly suited to building site development and sewage lagoons. Surface and subsurface drains can reduce the wetness. The soil is generally unsuited to septic tank absorption fields because of the wetness and the moderately slow permeability.

The land capability classification is IIe. The Michigan soil management group is 2.5b.

54—Palms muck. This nearly level, very poorly drained soil is in swamps, along drainageways and flood plains, and in depressions on uplands. It is subject to ponding and flooding. Areas are irregularly shaped and range from 6 to 120 acres in size.

Typically, the surface tier is dark brown muck about 18 inches thick. The lower tier is dark reddish brown, friable muck about 6 inches thick. The substratum to a depth of about 60 inches is very dark grayish brown sandy loam and gray silt loam and fine sandy loam. In some areas the muck is less than 16 inches thick. In some small areas the substratum is sand.

Included with this soil in mapping are small areas of the very poorly drained Houghton soils. These soils have more than 51 inches of muck. They make up 5 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the layers of muck in the Palms soil and moderate or

moderately slow in the loamy substratum. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface during most of the year.

Most areas of this soil are used as cropland. Some are used for specialty crops or are wooded.

If drained, this soil is fairly well suited to corn, small grain, carrots, and radishes. The major management concerns are wetness and soil blowing. Open ditches and tile can be effective in removing excess water. In many areas, however, draining the soil is difficult because drainage outlets are not readily available. Windbreaks, wind stripcropping, and cover crops help to control soil blowing.

Because of the wetness, this soil is only fairly well suited to pasture. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is frozen. Special equipment that does not damage surface root systems and harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Because of the wetness and the ponding, establishing seedlings is difficult.

Building site development and onsite waste disposal are not practical on this soil. Overcoming the wetness and instability of the soil is extremely difficult.

The land capability classification is IIIw. The Michigan soil management group is M/3c.

56—Pewamo silt clay loam. This nearly level, poorly drained soil is in depressions and drainageways. It is subject to ponding. Areas are irregular in shape and range from 3 to 30 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is about 25 inches thick. It is mottled and firm. The upper part is dark gray silty clay loam, and the lower part is grayish brown silty clay. The substratum to a depth of about 60 inches is dark grayish brown and dark gray, mottled clay loam. In some places the subsoil has less clay, and in other places it is stratified.

Permeability is moderately slow. Available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in winter and spring.

Most areas of this soil are used as cropland. A few are wooded.

If drained, this soil is well suited to corn and soybeans. The major management concerns are removing excess water and maintaining good tilth. Surface and subsurface drains can reduce the wetness. Good tilth can be maintained by restricting fieldwork during wet periods and by applying a system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface.

This soil is fairly well suited to pasture. The major management concerns are maintaining tilth and reducing the wetness. Grazing during wet periods can result in surface compaction and excessive runoff. Rotation grazing and deferment of grazing during wet periods help to maintain tilth. The pasture species that can tolerate the wetness should be selected for planting.

This soil is poorly suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the windthrow hazard. Equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate in some areas. The windthrow hazard can be reduced by avoiding heavy cuttings that leave the remaining trees widely spaced.

Because of the ponding, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IIw. The Michigan soil management group is 1.5c.

60—Belleville loamy sand. This nearly level, poorly drained or very poorly drained soil is in depressional areas and drainageways. It is subject to ponding. Areas are irregular in shape and range from 10 to 250 acres in size.

Typically, the surface layer is very dark gray loamy sand about 11 inches thick. The subsurface layer is dark grayish brown and grayish brown loamy sand about 3 inches thick. The subsoil is about 18 inches thick. It is mottled. The upper part is light brownish gray, loose sand, and the lower part is dark gray and dark yellowish brown, friable sandy loam. The substratum to a depth of about 60 inches is gray, mottled silty clay loam and clay loam. In places the surface layer is sandy loam.

Permeability is rapid in the sandy material and moderately slow in the loamy material. Available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is at or near the surface from November through May.

Most areas of this soil are used as cropland. Some are wooded.

If drained, this soil is fairly well suited to corn and soybeans. The major management concerns are excess water and soil blowing. Surface drains and subsurface tile are needed to remove the excess water. Soil blowing can be controlled by cover crops, field windbreaks, and a system of conservation tillage that does not invert the soil and that leaves crop residue on the surface.

This soil is fairly well suited to pasture. The major management concern is the wetness. Grazing should be restricted during wet periods.

This soil is well suited to woodland. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Equipment should

be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, reduces the seedling mortality rate in some areas. The windthrow hazard can be reduced by avoiding heavy cuttings that leave the remaining trees widely spaced.

Because of the ponding, this soil is generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is IIIw. The Michigan soil management group is 4/2c.

61B—Udipsamments and Udorthents, 0 to 4 percent slopes. These soils are in areas where cutting and filling have altered the landscape. In some areas the original surface layer and some of the subsoil have been removed. In other areas the lower, wetter, debris-filled depressions have been covered with sandy or loamy material.

These soils are used mainly for recreational, industrial, and residential development. Some of the acreage is idle land. Onsite investigation is needed to determine the suitability for specific uses.

These soils are not assigned to interpretive groups.

62—Pits. This map unit consists of excavations from which soil and the underlying sand and gravel have been removed. In areas where the excavations are deeper than the water table, ponding frequently occurs. Areas range from 3 to 60 acres in size.

Most areas are still mined for sand and gravel. This unit is unsuitable for cropland, pasture, and woodland. It varies too greatly to be rated for other uses. The ponds that have been created in the pits are used as watering holes by many species of wildlife. Some pits contain small amounts of trash and rubbish. Onsite investigation is needed to determine the suitability for specific uses.

This map unit is not assigned to interpretive groups.

64B—Urban land-Coloma complex, 0 to 6 percent slopes. This map unit consists of Urban land and a nearly level and undulating, somewhat excessively drained Coloma soil. The unit is on small ridges and knolls. Areas range from 20 to 500 acres in size. They are about 60 percent Urban land, 30 percent Coloma soil, and 10 percent other soils. The Urban land and Coloma soil occur as areas so intricately mixed or so small that mapping them separately is not practical.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soil series is not feasible.

Typically, the Coloma soil has a surface layer of dark brown loamy sand about 10 inches thick. The subsurface layer is about 31 inches of yellowish brown loamy sand and brownish yellow sand. The subsoil is about 10 inches of brownish yellow, loose sand that has very thin bands of strong brown loamy sand. The substratum to a depth of about 60 inches is yellowish brown sand that has thin bands of strong brown loamy sand. In some places the subsoil has no bands. In other places the total thickness of the bands is more than 6 inches. In some areas the subsoil has more clay.

Included with this unit in mapping are small areas of Oshtemo soils. These soils are less droughty than the Coloma soil. They are in landscape positions similar to those of Coloma soil. They make up about 5 percent of the unit.

Permeability is rapid in the Coloma soil. Available water capacity is low. Surface runoff is slow.

The Coloma soil is used for gardens, borrow areas, lawns, or building site development or is idle land. It is well suited to building site development.

In the areas where the Coloma soil is used for gardens, the major management concerns are droughtiness and soil blowing. The perennial plants that can withstand the droughtiness are better suited than other plants. A vegetative cover and mulch can help to control soil blowing.

Sanitary facilities should be connected to a central sewer system or treatment facility.

This map unit is not assigned to interpretive groups.

65B—Urban land-Brems complex, 0 to 4 percent slopes. This map unit consists of Urban land and a nearly level or undulating, moderately well drained Brems soil. The unit is on broad flats and low ridges. Areas range from 3 to 60 acres in size. They are about 70 percent Urban land, 20 percent Brems soil, and 10 percent other soils. The Urban land and Brems soil occur as areas so intricately mixed that mapping them separately is not practical.

The Urban land is covered by streets, parking lots, buildings, and other structures that so obscure or alter the soils that identification of the soil series is not feasible.

Typically, the Brems soil has a surface layer of dark brown sand about 10 inches thick. The subsoil is about 13 inches thick. The upper part is dark yellowish brown, loose loamy sand, and the lower part is yellowish brown, mottled, loose sand. The substratum to a depth of about 60 inches is brownish yellow, mottled sand. In some areas the subsoil has finer sand.

Permeability is rapid in the Brems soil. Available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2 to 3 feet from January through April.

The Brems soil is used for gardens, borrow areas, or building site development or is idle land. The major management concerns in the areas used for gardens are droughtiness and soil blowing. The perennial plants that can withstand the droughtiness are better suited than other plants. A vegetative cover and mulch can reduce the susceptibility to soil blowing.

The Brems soil is only fairly well suited to building site development because of the wetness. Buildings can be constructed on raised, well compacted fill material. A drainage system helps to lower the water table. Sanitary facilities should be connected to a central sewer system or treatment facility.

This map unit is not assigned to interpretive groups.

66—Algansee-Cohoctah complex. These nearly level soils are on flood plains along rivers and creeks. They are frequently flooded. The Algansee soil is somewhat poorly drained, and the Cohoctah soil is poorly drained or very poorly drained. Areas are elongated and range from 10 to 100 acres in size. They are about 40 percent Algansee soil and 35 percent Cohoctah soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Algansee soil has a surface layer of very dark grayish brown fine sandy loam about 7 inches thick. The substratum to a depth of about 60 inches is multicolored loamy fine sand and sand. In some places it is grayer. In other places the upper part of the substratum is not mottled.

Typically, the Cohoctah soil has a surface layer of very dark grayish brown sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is mottled. It is dark grayish brown fine sandy loam in the upper part, grayish brown sandy loam in the next part, and dark gray fine sandy loam in the lower part. In places the substratum is not so gray.

Included with these soils in mapping are small areas of moderately steep or steep soils bordering the uplands. Also included are small areas of the organic Houghton soils in oxbows. Included soils make up about 25 percent of the unit.

Permeability is moderately rapid in the Cohoctah soil and rapid in the Algansee soil. Available water capacity is moderate in the Cohoctah soil and low in the Algansee soil. Surface runoff is very slow or ponded on both soils. The seasonal high water table is at or near the surface from September through May.

Most areas are wooded (fig. 10). Some areas are used as cropland. These soils are generally unsuitable as cropland. The major management concerns are the flooding and the wetness. Draining the soils is difficult because the water table is often near the water level in the adjacent rivers and creeks. The flooding occurs after heavy rains and in spring.

These soils are poorly suited to pasture. The major management concerns are flooding and water pollution. Grazing can result in water pollution unless the access of livestock to creeks and rivers is restricted.

These soils are fairly well suited to woodland. The major management concerns are the flooding, the equipment limitation, seedling mortality, and the windthrow hazard. Overstocking and planting water-tolerant seedlings reduce the seedling mortality rate. Equipment should be used only when the ground is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Overcoming the flooding hazard is difficult.

These soils are poorly suited to recreational development. The flooding and the wetness are the major management concerns. The soils are not suited to camp areas or playgrounds because of the flooding. Because of the wetness, use should be limited to the drier periods or fill material is needed.

Because of the frequent flooding, these soils are generally unsuited to building site development, septic tank absorption fields, and sewage lagoons.

The land capability classification is Vw. The Michigan soil management groups are L-2c and L-4c.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 130,000 acres in the survey area, or nearly 33 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county but are mainly in associations 3 and 4, which are described under the heading "General

Figure 10.—A wooded area of the Algansee-Cohoctah complex along the Paw Paw River.

Soil Map Units." About 120,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn, soybeans, apples, and grapes, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not the limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Randall S. Seelbrede, district conservationist, and Jerry Grigar, agronomist, Soil Conservation Service, helped write this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Approximately 227,329 acres in Van Buren County, or about 57 percent of the total land area, is farmland. More than 156,969 acres is used for crops and pasture (*12*). Of this total, 54,000 acres is used for corn for grain and silage; 7,180 acres for wheat and oats; 9,000 acres for soybeans; 20,000 acres for hay crops, primarily alfalfa; 9,873 acres for permanent pasture; more than 22,750 acres for tree and bush fruits, such as cherries, apples, peaches, and blueberries; and more than 22,000 acres for other specialty crops, such as asparagus, snap beans, cucumbers, peppers, tomatoes, melons, and strawberries.

The main management needs in the areas of the county used for crops and pasture are measures that help to control water erosion and soil blowing, reduce wetness, conserve soil moisture, and improve fertility and tilth.

Water erosion and *soil blowing* are major management concerns on most of the cropland in the county. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. The topsoil holds plant nutrients and the applied commercial fertilizer. These essential nutrients are not available for plant growth when they are carried away along with the topsoil that washes downslope or into lakes and streams. Lost of the surface layer is especially damaging on soils that have a clayey subsoil, such as Riddles and Capac soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Spinks and Plainfield soils.

Second, erosion on farmland results in the sedimentation of lakes and streams. Controlling erosion minimizes this pollution by sediment and pesticides and improves the quality of water for municipal and recreation uses and for fish and other wildlife.

Water erosion is a serious hazard on the finer textured soils that have a slope of 2 percent or more and on coarse textured soils that have a slope of more than 4

percent. Preparing a good seedbed is difficult on some of the soils because the friable surface layer has been eroded away in places.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods reduces the susceptibility to erosion and preserves the productive capacity of the soil. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence helps to control erosion on the more sloping land, provides nitrogen for subsequent crops, and improves tilth. Conservation tillage helps to control surface runoff and erosion by leaving protective amounts of crop residue on the surface. Cover crops, diversions, grade stabilization structures, and grassed waterways help to prevent the gully erosion caused by concentrated runoff in field drainageways.

Soil blowing is a hazard on Coloma, Oakville, Ottokee, Spinks, Plainfield, Metea, Ormas, Grattan, and Selfridge soils and on the mucky Houghton, Edwards, Palms, and Adrian soils. It can damage these soils in a few hours, especially the mucky soils, if the wind is strong, the soils are dry, and the surface is bare. An adequate plant cover, surface mulch, buffer strips, and tillage methods that leave the surface rough greatly reduce the susceptibility to soil blowing. Soil blowing also can be controlled by wind barriers, such as tall wheatgrass or rye; windbreaks; and conservation tillage.

No-tillage, which is increasingly common in the county, is most effective in controlling water erosion and soil blowing because it leaves crop residue on the surface. It is suited to most of the soils in the county. It is not so successful, however, on soils that have loamy surface layer and are poorly drained. Because of no-tillage, erosive or droughty soils that otherwise are only marginally productive can be used for corn. No-tillage helps to maintain the productive capacity of nearly all cropland. In areas where no-till crops are grown, different methods of planting and of controlling insects and weeds are needed. The proper time for planting, the selection of herbicides that are suited to the existing vegetation, an adequate supply of plant nutrients, and the selection of tillage systems based on soil characteristics are important management requirements.

Information about the design and application of erosion-control practices for different soils is available in local offices of the Soil Conservation Service.

Soil drainage is a major management concern in some of the areas used for crops and pasture. Drainage of cropland improves the air-water relationship in the root zone. In areas where drainage is poor, spring planting, spraying, and harvesting are delayed and controlling weeds is difficult. Properly designed subsurface drainage systems, surface drainage systems, or both can be used to remove excess water.

Unless drained, some soils are naturally so wet that they cannot be used for the crops commonly grown in the county. Unless drained, very poorly drained, poorly drained, and somewhat poorly drained soils are so wet that crops are damaged in most years. Examples are Houghton, Selfridge, Cohoctah, Blount, Capac, and Pewamo soils. Natural drainage is good in Riddles and Kalamazoo soils most of the year, but these soils tend to dry slowly after rains. Small areas of the wetter soils along drainageways and in swales are commonly included in some areas of these soils, especially where slopes are 2 to 6 percent. Artificial drainage is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface drains and subsurface drains is needed in most areas of poorly drained and very poorly drained soils that are intensively row cropped. The drains should be more closed spaced in slowly permeable soils than in the more permeable soils. Subsurface drainage is slow or very slow in Blount, Capac, and Pewamo soils. Finding adequate outlets for subsurface drainage systems is difficult in many areas of Cohoctah, Adrian, Granby, Glendora, Houghton, and Sloan soils. Diversions can be used to remove surface runoff from some wet areas. Good tilth and an ample supply of organic matter also improve drainage. In low lying areas the growing season is shortened by frost late in spring and early in fall.

Organic soils oxidize and subside when their pore space is filled with air. As a result, special systems are needed to control the depth and periods of drainage. Maintaining the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of these soils.

Information about design of drainage systems for each kind of soil is available in local offices of the Soil Conservation Service.

Conserving *soil moisture* during dry periods is a concern in managing Kalamazoo, Oshtemo, Metea, Selfridge, and Spinks soils. Moisture can be conserved by no-tillage and other kinds of conservation tillage that leave all or most of the crop residue on the surface. Increasing the organic matter content improves the available water capacity.

In Van Buren County, most of the soils used for crops are medium textured to coarse textured and are well drained. As a result, the extent of irrigation is rapidly increasing. It increased from 16,000 acres in 1978 to 27,000 acres in 1982. Proper application rates, timely applications, and control of runoff reduce the susceptibility to erosion and help to prevent the contamination of ground water by leached nitrates.

Soil fertility is naturally medium or high in loamy soils and low in most sandy soils on uplands. Soils on flood plains, such as Cohoctah, Sloan, and Ceresco soils, range from slightly acid to mildly alkaline and are

naturally higher in content of plant nutrients than most soils on uplands.

Many sandy soils naturally range from strongly acid to slightly acid. If lime has never been applied on these soils, applications of ground limestone are needed to raise the pH level sufficiently for good growth of alfalfa and other crops that grow well only on nearly neutral soils. On all soils additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Some of the soils used for crops have a loamy surface layer that is light in color and low in organic matter content. Generally, the structure of such soils is weak, and intense rainfall causes the surface to crust. This crusting hinders the emergence of plant seedlings, decreases the rate of water infiltration, and increases the runoff rate. Cover crops and regular additions of manure and other organic material improve tilth and help to prevent surface crusting.

Because of the content of clay, maintaining good tilth is difficult in Blount and Pewamo soils. These soils stay wet until late in spring. If plowed when wet, they tend to be compacted and very cloddy when dry. As a result, preparing a good seedbed is difficult. Applying a system of conservation tillage, including grasses and legumes in the cropping sequence, growing cover crops, adding manure, and restricting field traffic improve tilth and help to prevent surface crusting and subsurface compaction. Fall plowing and chisel plowing at the proper moisture content can help to prevent deterioration of tilth in nearly level, poorly drained or somewhat poorly drained soils. Also, they allow the soils to be tilled earlier the following spring. Fall plowing is not suitable, however, on sloping soils or on soils that are subject to soil blowing. Management that maintains tilth is especially needed in intensively cropped areas.

On soils that have a loamy surface layer, grazing during wet periods results in compaction and poor tilth. Compaction retards the growth of pasture plants. Proper harvesting methods, such as those for hay or silage, increase plant growth and help to prevent compaction.

Permanent pasture in the county commonly is in areas where erosion is a hazard. Control of erosion is particularly important when the pasture is seeded. Forage production and the extent to which the plant cover protects the surface of the soil are influenced by the number of livestock that the pasture supports, the length of time that they graze, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the key forage species, pasture rotation, deferred grazing, timely grazing, and strategic location of water supplies for livestock.

Seeding mixtures of pasture plants increases forage production. On well drained, loamy soils, such as Kalamazoo and Riddles soils, a mixture of alfalfa, smooth bromegrass, and timothy is commonly used. On well drained or moderately well drained soils that have a surface layer of sandy loam, loamy sand, or loamy fine sand, such as Oshtemo, Ottokee, and Spinks soils, a mixture of alfalfa and smooth bromegrass or of smooth bromegrass and timothy is commonly used. On fields where the soils range from well drained to poorly drained, the mixture is commonly alfalfa, timothy, and red clover; alfalfa, red clover, smooth bromegrass, and timothy; or smooth bromegrass, timothy, and orchardgrass. In undrained areas of poorly drained or very poorly drained, mineral soils, such as Gilford and Pewamo soils, a mixture of smooth bromegrass and birdsfoot trefoil is commonly used or smooth bromegrass is seeded alone. On organic soils that have been drained, such as Houghton and Palms soils, smooth bromegrass is seeded alone. On organic soils that have not been drained, reed canarygrass can be seeded.

When legume-grass mixtures are planted in the spring, applications of nitrogen fertilizer and a companion crop of oats are beneficial. The nitrogen and oats commonly are omitted when birdsfoot trefoil is seeded. No companion crop is needed when the mixtures are seeded in summer.

More information about seeding mixtures and seeding times is available at local offices of the Cooperative Extension Service and the Soil Conservation Service.

Specialty crops commercially grown in the county include a variety of vegetables and fruits. Because of the diversity of soils, topography, and crops, careful selection of sites and management systems is needed. Some specialty crops, such as asparagus and tree, bush, and vine fruits, require long establishment periods, which in turn require large capital investments. Sites should be carefully selected in order to ensure profitable returns once the crops become productive. Some sites are better suited to fruit and vegetable crop production than others, mainly because of differences in air temperature caused by variations in elevations and air drainage and by the proximity to Lake Michigan, which has a moderating effect on the temperature. The soils on the site determine the management practices needed, the growth rate, the productivity of the crop, and the lifespan of the enterprise.

The major tree, bush, and vine fruits grown in the county are peaches, cherries, apples, blueberries, and grapes. Peaches, cherries, and grapes require the most frost free sites, good air drainage, and well drained, medium textured to coarse textured soils. Intensive cover crop management and applications of lime and fertilizer are needed to control erosion and maintain productivity. If the site is irrigated by a trickle system, peaches and cherries can be grown with a sod cover crop in areas where erosion is a severe hazard. Apples are suited to

the less well drained, finer textured soils. Permanent sod cover crops generally are used to control erosion.

Blueberries are primarily restricted to acidic, coarse textured sands or mucks that have a water table within 18 inches of the surface. Adequate surface drainage and control of the water table are needed. Annual cover crops provide adequate protection against erosion.

Asparagus is grown on coarse textured, well drained soils. It should not be grown on soils that have a slope of more than 4 percent because of the hazard of excessive erosion. Ferns should be mowed in the spring, and weeds should be controlled by herbicides. On flat fields, shallow disking also can control weeds unless soil blowing is a hazard.

Some of the other vegetable and small fruit crops grown in the county are snap beans, cucumbers, peppers, tomatoes, strawberries, and melons. These crops are well suited to well drained, medium textured to coarse textured soils. They produce very little canopy or protective residue for erosion control or organic matter buildup. Therefore, they should not be grown in areas where the slope is more than 4 percent. Intensive cover crop management and windbreaks or vegetative barriers of tall grasses or grain are needed to prevent excessive soil blowing and crop damage. These crops are irrigated.

Small acreages of onions, carrots, celery, radishes, cabbage, and cauliflower are grown on the mucks in the county. The measures needed to control soil blowing are similar to those needed in areas used for other vegetable crops.

Grain and hay crops are grown on a variety of soils that are not used for specialty crops. Minimum tillage and no-till planting systems are used in areas where corn, soybeans, oats, wheat, and alfalfa are grown. No-till planting is especially effective because most of the soils are loamy sands and sandy loams that become droughty unless an adequate amount of crop residue is left on the surface. These crops respond well to irrigation.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in tables 6 and 7. In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in table 6.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in tables 6 and 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*10*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 8. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in table 6. Also given at the end of each map unit description is a Michigan soil management group. The soils are assigned to a group according to the need for lime and fertilizer and for artificial drainage and other practices. For soils making up a complex, the management groups are listed in the same order as the series named in the complex (*5*).

Woodland Management and Productivity

Table 9 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling

mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Two primary types of windbreaks are needed in Van Buren County. One type is the farmstead windbreak, which protects farmsteads from cold winter winds, thereby conserving energy and keeping snow from drifting in critical areas. Dense, multiple rows of trees and shrubs generally are needed to protect the farmsteads. The second type of windbreak is the field windbreak, which is needed to control soil blowing and to prevent crop damage, especially in the spring, when the crops are becoming established. The trees and shrubs generally needed in field windbreaks are those that grow rapidly and have a narrow base. These windbreaks are especially important on soils that have a surface layer of fine sand and on organic soils. In all windbreaks, planting a variety of trees and shrubs helps to prevent disease and insect buildup.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design,

intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, ragweed, and milkweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone,

available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, blackberry, raspberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, honeysuckle, nannyberry viburnum, and silver buffaloberry.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, potholes, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, ring-necked pheasant, meadowlark, field sparrow, cottontail rabbit, red fox, and mourning dove.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, tree squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, the available water capacity in the upper 40 inches, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of

more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a

system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and large stones affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the

susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 19 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*11*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*9*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*11*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Adrian Series

The Adrian series consists of very poorly drained soils in old lakebeds and on flood plains. These soils formed in deposits of organic material 16 to 50 inches deep over sandy deposits. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Slope is 0 to 1 percent.

Adrian soils are similar to Edwards, Houghton, and Palms soils and are commonly adjacent to Edwards, Gilford, Houghton, Kingsville, and Palms soils. Edwards soils are organic to a depth of 16 to 50 inches and are underlain by marl. Gilford and Kingsville soils formed in

mineral deposits and are in the slightly higher landscape positions. Houghton soils are organic to a depth of more than 51 inches. Palms soils are organic to a depth of 16 to 50 inches and are underlain by loamy material.

Typical pedon of Adrian muck, 1,875 feet south and 1,176 feet west of the northeast corner of sec. 1, T. 3 S., R. 14 W.

Oa1—0 to 12 inches; black (N 2/0), broken face, sapric material, black (10YR 2/1) rubbed; less than 2 percent fibers, less than 2 percent rubbed; primarily herbaceous fibers; moderate medium granular structure; many fine roots; neutral; abrupt smooth boundary.

Oa2—12 to 19 inches; black (10YR 2/1), broken face and rubbed, sapric material; 5 to 10 percent fibers, less than 2 percent rubbed; primarily herbaceous fibers; weak coarse subangular blocky structure; common very fine roots; neutral; abrupt smooth boundary.

Oa3—19 to 36 inches; very dark brown (10YR 2/2), broken face, sapric material, black (10YR 2/1) rubbed; 25 to 30 percent fibers, 5 to 10 percent rubbed; primarily herbaceous fibers; massive; few very fine roots; neutral; abrupt smooth boundary.

C—36 to 60 inches; dark gray (10YR 4/1) sand; single grain; loose; moderately alkaline.

The organic material is 16 to 50 inches deep over sandy material. It ranges from slightly acid to mildly alkaline. The content of woody fragments ranges from 2 to 5 percent in some pedons.

The Oa horizon has hue of 10YR, 7.5YR, 5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The C horizon has value of 3 or 4 and chroma of 1 or 2. It is sand or coarse sand.

Algansee Series

The Algansee series consists of somewhat poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope is 0 to 2 percent.

Algansee soils are similar to Glendora and Morocco soils and are commonly adjacent to Cohoctah, Glendora, and Houghton soils. The adjacent soils are in the lower landscape positions. Cohoctah soils are poorly drained and are coarse-loamy. Glendora soils are poorly drained. Houghton soils formed in more than 51 inches of organic material. Morocco soils are on sandy uplands.

Typical pedon of Algansee fine sandy loam, in an area of Algansee-Cohoctah complex, 1,584 feet south and 1,452 feet east of the northwest corner of sec. 9, T. 3 S., R. 16 W.

A—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, pale brown (10YR 6/3) dry; moderate fine granular structure; very friable; many fine roots; slightly acid; abrupt wavy boundary.

C1—7 to 12 inches; yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) loamy fine sand; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; very friable; few medium roots; few medium dark gray (10YR 4/1) organic stains; medium acid; clear wavy boundary.

C2—12 to 26 inches; strong brown (7.5YR 4/6) sand; few fine prominent very pale brown (10YR 7/3) and few medium prominent light brownish gray (10YR 6/2) mottles; single grain; loose; medium acid; abrupt wavy boundary.

C3—26 to 43 inches; pale brown (10YR 6/3) sand; many coarse prominent strong brown (7.5YR 4/6) and few medium distinct grayish brown (10YR 5/2) mottles; single grain; loose; medium acid; diffuse wavy boundary.

Cg—43 to 60 inches; light brownish gray (10YR 6/2) sand that has dark gray (10YR 4/1) and very dark gray (10YR 3/1) lenses of very fine sandy loam; few medium prominent strong brown (7.5YR 4/6) mottles; single grain; loose; medium acid.

The control section ranges from medium acid to mildly alkaline. It is dominantly sand to loamy fine sand. In some pedons, however, it has thin strata of loam to fine sandy loam.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loamy sand, sand, and sandy loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 to 6, and chroma of 2 to 6. Some pedons have thin strata of loam or fine sandy loam. Some have free carbonates below a depth of 40 inches.

Belleville Series

The Belleville series consists of poorly drained and very poorly drained soils on lake plains and till plains. These soils formed in sandy and loamy material. Permeability is rapid in the sandy material and moderately slow in the loamy material. Slope is 0 to 1 percent.

Belleville soils are similar to Kingsville soils and are commonly adjacent to Capac, Kingsville, and Selfridge soils. The somewhat poorly drained Capac and Selfridge soils are in the higher landscape positions. Capac soils are loamy throughout. Kingsville soils do not have loamy underlying material.

Typical pedon of Belleville loamy sand, 1,980 feet west and 1,509 feet south of the northeast corner of sec. 20, T. 3 S., R. 16 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) loamy sand, gray (10YR 5/1) dry; weak medium granular structure; friable; many fine and medium roots; slightly acid; abrupt wavy boundary.

E—11 to 14 inches; dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) loamy sand; very few fine distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; very friable; few fine roots; slightly acid; gradual smooth boundary.
Bg1—14 to 28 inches; light brownish gray (10YR 6/2) sand; many coarse prominent yellowish brown (10YR 5/6) mottles; single grain; loose; slightly acid; clear wavy boundary.
Bg2—28 to 32 inches; dark gray (N 4/0) and dark yellowish brown (10YR 4/6) sandy loam; few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; slightly acid; abrupt wavy boundary.
2Cg1—32 to 38 inches; gray (10YR 6/1) silty clay loam; few fine distinct brownish yellow (10YR 6/6) and many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; neutral; clear wavy boundary.
2Cg2—38 to 60 inches; gray (N 6/0) clay loam; few medium prominent brownish yellow (10YR 6/6) and many coarse prominent yellowish brown (10YR 5/4) mottles; massive; very firm; gray (10YR 6/1) lime accumulations; very slight effervescence; mildly alkaline.

The depth to the 2C horizon ranges from 20 to 40 inches. The solum ranges from slightly acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bg horizon has value of 5 or 6 and chroma of 0 to 2. It is sand, loamy sand, or sandy loam. The 2Cg horizon has hue of 10YR or 2.5Y or is neutral in hue. It has value of 5 or 6 and chroma of 0 to 3. It is silty clay loam, clay loam, or loam.

Blount Series

The Blount series consists of somewhat poorly drained, slowly permeable or moderately slowly permeable soils on till plains. These soils formed in clayey and loamy material. Slope ranges from 0 to 4 percent.

Blount soils are similar to Pewamo soils and are commonly adjacent to Pewamo and Selfridge soils. Pewamo soils are in the slightly lower positions on the landscape and are poorly drained. Selfridge soils are sandy to a depth of more than 20 inches and are underlain by loamy material. They are in landscape positions similar to those of the Blount soils.

Typical pedon of Blount silt loam, 0 to 4 percent slopes, 504 feet west and 201 feet south of the northeast corner of sec. 1, T. 3 S., R. 15 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; many fine roots; about 2 percent pebbles; neutral; clear wavy boundary.
Bt1—9 to 15 inches; yellowish brown (10YR 5/4) silty clay; few medium distinct grayish brown (10YR 5/2) and common fine distinct brown (10YR 5/3) mottles; moderate medium angular blocky structure; firm; few fine roots; few thin grayish brown (10YR 5/2) clay films; about 2 percent pebbles; neutral; gradual wavy boundary.
Bt2—15 to 28 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and many medium distinct brown (10YR 5/3) mottles; strong medium angular blocky structure; very firm; few fine roots; common thick grayish brown (10YR 5/2) clay films; about 2 percent pebbles; neutral; gradual wavy boundary.
C—28 to 60 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct gray (5Y 6/1) and common medium faint brown (10YR 5/3) mottles; massive; firm; many thick white (10YR 8/2) lime accumulations; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 22 to 30 inches and coincides with the depth to free carbonates. The solum is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. Some pedons have an E horizon. This horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. It is loam or silt loam. The Bt horizon has value of 4 to 6 and chroma of 1 to 4. It is silty clay, silty clay loam, or clay loam. The C horizon has value of 4 to 6 and chroma of 1 to 4. It is clay loam or silty clay loam.

Brems Series

The Brems series consists of moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope is 0 to 2 percent.

Brems soils are similar to Morocco and Plainfield soils and are commonly adjacent to Kingsville, Morocco, and Plainfield soils. The poorly drained Kingsville soils and the somewhat poorly drained Morocco soils are in the lower landscape positions. The well drained Plainfield soils are in the higher landscape positions.

Typical pedon of Brems sand, 0 to 2 percent slopes, 147 feet south and 859 feet west of the northeast corner of sec. 36, T. 2 S., R. 14 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; strongly acid; abrupt smooth boundary.

Bw1—10 to 17 inches; dark yellowish brown (10YR 4/6) loamy sand; single grain; loose; strongly acid; clear smooth boundary.

Bw2—17 to 23 inches; yellowish brown (10YR 5/6) sand; many medium and coarse faint strong brown (7.5YR 4/6) and common fine faint brown (10YR 5/3) mottles; single grain; loose; strongly acid; clear wavy boundary.

BC—23 to 60 inches; brownish yellow (10YR 6/6) sand; common medium distinct light brownish gray (10YR 6/2) mottles below a depth of 30 inches; single grain; loose; many pockets of yellowish red (5YR 5/8 and 4/6) iron stains; strongly acid.

The thickness of solum ranges from 35 to more than 60 inches. Reaction ranges from strongly acid to slightly acid in the solum and is medium acid or strongly acid in the C horizon.

The Ap horizon has value of 3 to 5 and chroma of 3 or 4. It is dominantly sand, but the range includes loamy sand. Some pedons have an E horizon. This horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. The B horizon has hue of 10YR or 7.5YR and value and chroma of 4 to 6. It is sand, fine sand, or loamy sand. Some pedons have a C horizon. This horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 6.

Bronson Series

The Bronson series consists of moderately well drained soils on outwash plains. These soils formed in loamy and sandy material. Permeability is moderately rapid in the upper part of the pedon and rapid in the lower part. Slope is 0 to 3 percent.

Bronson soils are similar to Oshtemo soils and are commonly adjacent to Gilford, Oshtemo, and Spinks soils. The very poorly drained Gilford soils are in the lower positions on the landscape. The well drained Oshtemo and Spinks soils are in the higher positions on the landscape. Spinks soils do not have a continuous argillic horizon.

Typical pedon of Bronson sandy loam, 0 to 3 percent slopes, 2,568 feet north and 90 feet east of the southwest corner of sec. 34, T. 3 S., R. 14 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; about 3 percent pebbles; slightly acid; abrupt smooth boundary.

BE—9 to 20 inches; yellowish brown (10YR 5/6) sandy loam; weak fine subangular blocky structure; friable; about 2 percent pebbles; strongly acid; abrupt smooth boundary.

Bt1—20 to 29 inches; strong brown (7.5YR 5/6) sandy loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few thin clay films on faces of peds; about 3 percent pebbles; medium acid; abrupt wavy boundary.

Bt2—29 to 43 inches; strong brown (7.5YR 5/6) sandy clay loam; common coarse distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; common thin clay films on faces of peds; about 8 percent pebbles medium acid; clear smooth boundary.

2BC—43 to 56 inches; yellowish brown (10YR 5/4) loamy sand; weak fine subangular blocky structure; very friable; about 10 percent pebbles; medium acid; clear smooth boundary.

2C—56 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; about 10 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 41 to more than 60 inches and coincides with the depth to carbonates. Reaction ranges from strongly acid to neutral in the solum and from neutral to moderately alkaline in the 2C horizon.

The Ap horizon has chroma of 2 or 3. It is dominantly sandy loam, but the range includes loamy sand. Some pedons have an E horizon. This horizon has hue of 10YR, value of 5 to 7, and chroma of 2 or 3. It is loamy sand or sandy loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam or sandy clay loam. The 2C horizon has value of 5 or 6 and chroma of 2 or 3. It is sand, coarse sand, or gravelly sand.

Capac Series

The Capac series consists of somewhat poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy till. Slope ranges from 1 to 5 percent.

Capac soils are commonly adjacent to Riddles soils. The adjacent soils are well drained and are in the higher positions on the landscape.

Typical pedon of Capac loam, 1 to 5 percent slopes, 321 feet south and 825 feet west of the northeast corner of sec. 5, T. 4 S., R. 16 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine roots; about 5 percent pebbles; medium acid; abrupt smooth boundary.

BE—8 to 12 inches; grayish brown (10YR 5/2) loam; common medium distinct yellowish brown (10YR 5/8) and common medium faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; common fine roots; few thin grayish brown (10YR 5/2) clay films on faces of peds and between peds; brown (10YR 5/3) worm

casts; about 5 percent pebbles; medium acid; clear wavy boundary.

Bt1—12 to 20 inches; brown (10YR 5/3) clay loam; common medium distinct yellowish brown (10YR 5/8) and common fine faint grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; many thin grayish brown (10YR 5/2) clay films; about 5 percent pebbles; medium acid; gradual wavy boundary.

Bt2—20 to 27 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; few fine roots; few thin grayish brown (10YR 5/2) clay films; about 5 percent pebbles; neutral; abrupt wavy boundary.

C1—27 to 36 inches; brown (10YR 5/3) loam; common medium faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/6) mottles; weak thick platy structure parting to moderate medium angular blocky; friable; light gray (10YR 7/2) lime streaks; about 5 percent pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

C2—36 to 60 inches; brown (10YR 5/3) loam; few fine distinct yellowish brown (10YR 5/6) and few fine faint grayish brown (10YR 5/2) mottles; massive; friable; light gray (10YR 7/2) lime streaks; about 5 percent pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 27 to 40 inches and coincides with the depth to carbonates. Reaction ranges from medium acid to neutral in the solum and is mildly alkaline or moderately alkaline in the C horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loam, but the range includes sandy loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is loam or clay loam. The C horizon has chroma of 2 to 4. It is clay loam or loam.

Cohoctah Series

The Cohoctah series consists of poorly drained and very poorly drained, moderately rapidly permeable soils in nearly level areas, in depressions, and in shallow, abandoned drainageways on flood plains. These soils formed in loamy alluvium. Slope is 0 to 1 percent.

Cohoctah soils are similar to Glendora soils and are commonly adjacent to Algansee, Houghton, and Sloan soils. Algansee soils are sandy, are somewhat poorly drained, and are in the higher positions on the landscape. Glendora soils are sandier throughout than the Cohoctah soils. Houghton soils are muck to a depth of more than 51 inches. They are in the lower positions on the landscape. Sloan soils are finer textured than the Cohoctah soils. They are in landscape positions similar to those of the Cohoctah soils.

Typical pedon of Cohoctah sandy loam, in an area of Algansee-Cohoctah complex, 1,704 feet north and 2,196 feet east of the southwest corner of sec. 10, T. 3 S., R. 15 W.

A—0 to 10 inches; very dark grayish brown (10YR 3/2) sandy loam, gray (10YR 5/1) dry; weak medium granular structure; very friable; few medium roots; mildly alkaline; clear smooth boundary.

Cg1—10 to 20 inches; dark grayish brown (10YR 4/2) fine sandy loam; common medium distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; weak coarse subangular blocky structure; very friable; black (10YR 2/1) organic stains; very few fine roots; mildly alkaline; clear wavy boundary.

Cg2—20 to 41 inches; grayish brown (10YR 5/2) fine sandy loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; very friable; few thick dark brown (7.5YR 4/2) and few thin black (10YR 2/1) organic stains; mildly alkaline; clear wavy boundary.

Cg3—41 to 60 inches; dark gray (10YR 4/1) fine sandy loam; few medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; very friable; very dark gray (10YR 3/1) organic stains; mildly alkaline.

The mollic epipedon ranges from 10 to 19 inches in thickness. Reaction is neutral or mildly alkaline to a depth of 20 inches and is neutral to moderately alkaline below that depth.

The A horizon has value of 2 or 3. It is dominantly sandy loam, but the range includes loam. The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is sandy loam or fine sandy loam.

Coloma Series

The Coloma series consists of somewhat excessively drained, rapidly permeable soils on outwash plains and moraines. These soils formed in sandy material. Slope ranges from 0 to 25 percent.

Coloma soils are similar to Plainfield and Spinks soils and are commonly adjacent to Oshtemo and Plainfield soils. Oshtemo soils have a continuous argillic horizon, are well drained, and are in landscape positions similar to those of the Coloma soils. Plainfield soils do not have textural bands. Spinks soils have more than 6 inches of textural bands.

Typical pedon of Coloma loamy sand, 0 to 6 percent slopes, 60 feet west and 1,053 feet south of the northeast corner of sec. 2, T. 3 S., R. 13 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy sand, brown (10YR 5/3) dry; weak medium granular

structure; very friable; common fine, medium, and coarse roots; slightly acid; abrupt smooth boundary.

E1—10 to 21 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium granular structure; very friable; common medium and coarse roots; neutral; gradual smooth boundary.

E2—21 to 34 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; few medium roots; neutral; gradual smooth boundary.

E&Bt—34 to 60 inches; yellowish brown (10YR 5/6) sand (E); bands of strong brown (7.5YR 4/6) loamy sand (Bt), 1/8 to 1/4 inch thick; clay bridging between sand grains; single grain; loose; neutral.

The solum ranges from medium acid to neutral. The Ap horizon has value of 3 or 4. It is dominantly loamy sand, but the range includes sand and loamy fine sand. The E horizon has value and chroma of 4 to 6. It is sand, fine sand, or loamy sand. The E part of the E&Bt horizon has value of 5 or 6 and chroma of 4 to 6. It is sand or fine sand. The B part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is loamy sand or sandy loam. Some pedons have a C horizon. This horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. It is sand or banded sand and loamy sand.

Colwood Series

The Colwood series consists of poorly drained, moderately permeable soils on lake plains. These soils formed in stratified loamy and sandy material. Slope is 0 to 1 percent.

Colwood soils are commonly adjacent to Tuscola soils. The adjacent soils are moderately well drained and are in the higher landscape positions.

Typical pedon of Colwood silt loam, 50 feet west and 471 feet north of the southeast corner of sec. 21, T. 3 S., R. 16 W.

Ap—0 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; friable; many medium roots; neutral; abrupt smooth boundary.

Bg1—14 to 19 inches; grayish brown (10YR 5/2) clay loam; few fine faint dark yellowish brown (10YR 4/6) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; about 2 percent pebbles; few fine roots; neutral; gradual wavy boundary.

Bg2—19 to 26 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; mildly alkaline; gradual wavy boundary.

Bg3—26 to 30 inches; light olive gray (5Y 6/2) stratified silty clay loam and silt loam; common medium distinct light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; firm; mildly alkaline; gradual wavy boundary.

Bg4—30 to 35 inches; gray (5Y 6/1) silt loam; moderate medium distinct yellowish brown (10YR 5/6) and few fine distinct gray (N 6/0) mottles; moderate medium subangular blocky structure; firm; mildly alkaline; gradual wavy boundary.

C—35 to 60 inches; stratified grayish brown (2.5Y 5/2) silty clay loam, gray (N 6/0) silt loam, and light brownish gray (2.5Y 6/2) fine sandy loam; few medium distinct yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) mottles; common white (2.5Y 8/1) lime streaks; massive; very firm; strong effervescence; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. It is slightly acid to mildly alkaline.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes fine sandy loam and loam. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is silt loam, clay loam, or silty clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. It is stratified silt loam, very fine sand, fine sand, loamy very fine sand, fine sandy loam, or silty clay loam.

Covert Series

The Covert series consists of moderately well drained, rapidly permeable soils on lake plains. These soils formed in sandy material. Slope ranges from 0 to 4 percent.

Covert soils are similar to Pipestone soils and are commonly adjacent to Kingsville and Pipestone soils. Kingsville soils are poorly drained, do not have a spodic horizon, and are in the lower positions on the landscape. Pipestone soils are somewhat poorly drained and are in the slightly lower positions on the landscape.

Typical pedon of Covert sand, 0 to 4 percent slopes, 1,120 feet east and 2,370 feet south of the northeast corner of sec. 9, T. 2 S., R. 17 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

E—8 to 15 inches; light brownish gray (10YR 6/2) sand; single grain; loose; common roots; medium acid; clear wavy boundary.

Bs1—15 to 20 inches; dark reddish brown (5YR 3/4) sand; single grain; loose; few roots; medium acid; gradual wavy boundary.

Bs2—20 to 35 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few cemented chunks of ortstein; medium acid; gradual wavy boundary.

C—35 to 60 inches; pale brown (10YR 6/3) sand; few fine prominent yellowish brown (10YR 5/8) mottles; single grain; loose; medium acid.

The thickness of the solum ranges from 24 to 40 inches. Reaction ranges from very strongly acid to neutral in the solum and from medium acid to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sand, but the range includes loamy sand. The E horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 1 to 3. It is sand or loamy sand.

The B horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 3 to 6. It is sand or loamy sand. The content of ortstein in this horizon ranges from 0 to 30 percent.

The C horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 7, and chroma of 1 to 8. It is sand or fine sand.

Edwards Series

The Edwards series consists of very poorly drained soils in old lakebeds. These soils formed in organic material 16 to 50 inches deep over marl. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Edwards soils are similar to Adrian, Houghton, and Palms soils and are commonly adjacent to those soils. Adrian soils are organic to a depth of 16 to 50 inches and are underlain by sand. Houghton soils are organic to a depth of more than 51 inches. Palms soils are organic to a depth of 16 to 50 inches and are underlain by loamy material.

Typical pedon of Edwards muck, 105 feet east and 2,128 feet south of the northwest corner of sec. 26, T. 3 S., R. 14 W.

Op—0 to 10 inches; black (N 2/0), broken face and rubbed, sapric material; less than 2 percent fibers, less than 2 percent rubbed; primarily herbaceous fibers; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Oa1—10 to 31 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 20 percent fibers, 5 percent rubbed; primarily herbaceous fibers; weak coarse subangular blocky structure; friable; few very fine roots; neutral; clear smooth boundary.

Oa2—31 to 40 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 40 percent fibers, 8 percent rubbed; primarily herbaceous fibers; weak thick platy structure; friable; neutral; clear smooth boundary.

Oa3—40 to 48 inches; very dark grayish brown (10YR 3/2), broken face, sapric material, dark brown (10YR 3/3) rubbed; about 30 percent fibers, 5 percent rubbed; primarily herbaceous fibers; massive; friable; many seashells; violent effervescence; moderately alkaline; clear smooth boundary.

C—48 to 60 inches; light gray (10YR 7/1) marl; massive; friable; violent effervescence; moderately alkaline.

The depth to the C horizon ranges from 19 to 50 inches. The organic material ranges from medium acid to mildly alkaline.

The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR, value of 2 to 4, and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8, and chroma of 1 or 2. In some pedons the marl has a layer of sandy material that is 1 or 2 inches thick and is within a depth of 51 inches.

Gilford Series

The Gilford series consists of very poorly drained soils on outwash plains. These soils formed in sandy and loamy material. Permeability is moderately rapid in the upper part of the pedon and rapid in the lower part. Slope is 0 to 1 percent.

These soils are brighter colored in the Bg horizon than is definitive for the Gilford series. This difference, however, does not alter the usefulness or behavior of the soils.

Gilford soils are commonly adjacent to Bronson and Oshtemo soils. The moderately well drained Bronson soils and the well drained Oshtemo soils are in the higher positions on the landscape.

Typical pedon of Gilford sandy loam, 780 feet north and 65 feet west of the center of sec. 33, T. 4 S., R. 14 W.

Ap—0 to 14 inches; black (N 2/0) sandy loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bg1—14 to 18 inches; very dark grayish brown (10YR 3/2) sandy loam that has black (N 2/0) Ap material in root channels; moderate medium subangular blocky structure; friable; neutral; gradual wavy boundary.

Bg2—18 to 25 inches; light brownish gray (2.5Y 6/2) sandy loam that has black (N 2/0) material in root channels; massive; friable; neutral; clear irregular boundary.

Bg3—25 to 33 inches; grayish brown (2.5Y 5/2) loamy sand; few black (N 2/0) stains in root channels; massive; friable; neutral; clear smooth boundary.

2Bg4—33 to 35 inches; very dark grayish brown (2.5Y 3/2) sandy clay loam; common medium distinct olive (5Y 4/3) mottles; weak medium subangular blocky structure; firm; about 6 percent pebbles; neutral; clear wavy boundary.

2Cg1—35 to 48 inches; dark grayish brown (10YR 4/2) loamy sand; single grain; loose; neutral; gradual wavy boundary.
2Cg2—48 to 60 inches; grayish brown (10YR 5/2) loamy fine sand; single grain; loose; mildly alkaline.

The thickness of the solum ranges from 20 to 40 inches. Reaction ranges from medium acid to neutral in the solum and is neutral or mildly alkaline in the 2C horizon. The content of pebbles ranges from 0 to 15 percent in the solum and the 2C horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loam. The Bg horizon has hue of 10YR, 7.5YR, 5Y, or 2.5Y or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is dominantly sandy loam or gravelly sandy clay loam. In some pedons, however, it has thin layers of clay loam or silty clay loam. The 2C horizon has hue of 10YR, 7.5YR, or 5Y, value of 3 to 6, and chroma of 1 or 2. It is sand that has strata of coarse sand, loamy sand, or fine gravel.

Glendora Series

The Glendora series consists of very poorly drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvium. Slope is 0 to 1 percent.

Glendora soils are similar to Algansee and Cohoctah soils and are commonly adjacent to Algansee, Cohoctah, and Sloan soils. Algansee soils are somewhat poorly drained and are on slight rises on the flood plains. Cohoctah and Sloan soils are finer textured than the Glendora soils. They are in landscape positions similar to those of the Glendora soils.

Typical pedon of Glendora sandy loam, 132 feet east and 1,089 feet north of the southwest corner of sec. 10, T. 3 S., R. 16 W.

Ap—0 to 7 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak very fine granular structure; very friable; abundant fine roots; mildly alkaline; abrupt wavy boundary.
C1—7 to 17 inches; light gray (10YR 7/2) fine sand; few medium distinct dark yellowish brown (10YR 4/6) mottles; single grain; loose; very few fine roots; very dark gray (10YR 3/1) organic stains; mildly alkaline; abrupt wavy boundary.
C2—17 to 21 inches; grayish brown (10YR 5/2) fine sand; single grain; loose; very dark grayish brown (10YR 3/2) organic stains; mildly alkaline; abrupt wavy boundary.
C3—21 to 27 inches; white (10YR 8/2) fine sand; single grain; loose; grayish brown (10YR 5/2) organic stains; mildly alkaline; abrupt wavy boundary.
C4—27 to 34 inches; grayish brown (10YR 5/2) loamy fine sand; few fine distinct dark yellowish brown (10YR 4/6) and few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; black (10YR 2/1) organic stains; neutral; abrupt wavy boundary.
C5—34 to 56 inches; pale brown (10YR 6/3) fine sand; few fine distinct brownish yellow (10YR 6/6) mottles; single grain; loose; gray (10YR 5/1) organic stains; neutral; abrupt wavy boundary.
C6—56 to 60 inches; dark gray (10YR 4/1) fine sand; few fine prominent yellowish brown (10YR 5/8) and brown (10YR 5/3) mottles; single grain; loose; very dark gray (10YR 3/1) organic stains; slightly acid.

Reaction ranges from slightly acid to mildly alkaline throughout the pedon. The A horizon is dominantly sandy loam, but the range includes loam and fine sandy loam. The C horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 to 3. It is sand, fine sand, or loamy fine sand. Some pedons have organic bands. These bands have hue of 10YR, value of 2 to 5, and chroma of 1 or 2.

Grattan Series

The Grattan series consists of excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope ranges from 0 to 6 percent.

Grattan soils are similar to Plainfield soils and are commonly adjacent to Covert, Kingsville, and Pipestone soils. The adjacent soils are in the lower positions on the landscape. Covert soils are moderately well drained. Kingsville soils are poorly drained and do not have a spodic horizon. Pipestone soils are somewhat poorly drained. Plainfield soils do not have a spodic horizon.

Typical pedon of Grattan sand, 0 to 6 percent slopes, 201 feet north and 780 feet east of the southwest corner of sec. 4, T. 2 S., R. 17 W.

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) sand, gray (10YR 6/1) dry; very weak medium granular structure; very friable; many fine roots; light brownish gray (10YR 6/2) sand flecks; medium acid; abrupt smooth boundary.
E—11 to 14 inches; brown (7.5YR 5/2) sand; single grain; loose; few fine roots; slightly acid; abrupt wavy boundary.
Bhs—14 to 18 inches; dark reddish brown (5YR 3/3) and strong brown (7.5YR 5/6) sand; very weak medium subangular blocky structure; very friable; few fine roots; medium acid; clear broken boundary.
Bs—18 to 26 inches; strong brown (7.5YR 5/6) sand; very weak medium subangular blocky structure; very friable; few fine roots; medium acid; gradual wavy boundary.
C1—26 to 50 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; medium acid; gradual wavy boundary.

C2—50 to 60 inches; very pale brown (10YR 7/3) sand; single grain; loose; neutral.

The thickness of the solum ranges from 26 to 48 inches. Reaction is medium acid or slightly acid in the solum and medium acid to neutral in the C horizon.

The Ap horizon has value of 2 to 4 and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 1 or 2. The Bhs horizon has hue of 7.5YR or 5YR. The Bs horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 4 to 8. The C horizon has hue of 10YR or 7.5YR, value of 6 or 7, and chroma of 3 or 4.

Houghton Series

The Houghton series consists of very poorly drained soils in old lakebeds and drainageways. These soils formed in herbaceous organic material more than 51 inches thick. Permeability is moderately slow to moderately rapid. Slope is 0 to 1 percent.

Houghton soils are similar to Adrian, Edwards, and Palms soils and are commonly adjacent to those soils. Adrian soils are organic to a depth of 16 to 50 inches and are underlain by sand. Edwards soils are organic to a depth of 16 to 50 inches and are underlain by marl. Palms soils are organic to a depth of 16 to 50 inches and are underlain by loamy material.

Typical pedon of Houghton muck, 105 feet east and 2,253 feet south of the northwest corner of sec. 26, T. 3 S., R. 14 W.

Oa1—0 to 18 inches; black (N 2/0), broken face and rubbed, sapric material; about 2 percent fibers, less than 2 percent rubbed; moderate medium granular structure; few fine roots; neutral; abrupt wavy boundary.

Oa2—18 to 36 inches; black (10YR 2/1), broken face and rubbed, sapric material; about 30 percent fibers, less than 5 percent rubbed; massive; neutral; abrupt smooth boundary.

Oa3—36 to 60 inches; black (10YR 2/1), broken face and rubbed, sarpic material; about 40 percent fibers, 10 percent rubbed; massive; neutral.

The organic material is 51 to more than 60 inches thick. It is slightly acid to mildly alkaline. It has hue of 10YR, 7.5YR, or 5YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The organic fibers are primarily herbaceous. In some layers, however, 5 to 10 percent of the organic material is woody.

Kalamazoo Series

The Kalamazoo series consists of well drained soils on outwash plains. These soils formed in loamy and sandy material. Permeability is moderate in the upper part of the pedon and rapid in the lower part. Slope ranges from 0 to 12 percent.

Kalamazoo soils are commonly adjacent to Oshtemo, Riddles, and Spinks soils. The adjacent soils are in landscape positions similar to those of the Kalamazoo soils. Oshtemo soils have a subsoil that is coarser textured than that of the Kalamazoo soils. Riddles soils are loamy throughout. Spinks soils are sandy throughout and have a discontinuous argillic horizon.

Typical pedon of Kalamazoo loam, 0 to 2 percent slopes, 24 feet north and 2,265 feet east of the center of sec. 30, T. 4 S., R. 15 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; about 2 percent pebbles; few fine and medium roots; medium acid; abrupt smooth boundary.

BE—10 to 12 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; about 2 percent pebbles; very few fine roots; slightly acid; gradual smooth boundary.

Bt1—12 to 20 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; many thin brown (7.5YR 4/4) clay films; about 2 percent pebbles; slightly acid; gradual smooth boundary.

Bt2—20 to 34 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; common thin brown (7.5YR 4/4) clay films; about 3 percent pebbles; slightly acid; gradual smooth boundary.

Bt3—34 to 39 inches; strong brown (7.5YR 4/6) gravelly sandy loam; weak medium subangular blocky structure; very friable; clay bridging between sand grains; about 20 percent pebbles; slightly acid; abrupt wavy boundary.

2BC—39 to 47 inches; strong brown (7.5YR 5/6) gravelly sand; single grain; loose; about 25 percent pebbles; neutral; abrupt wavy boundary.

2C—47 to 60 inches; strong brown (7.5YR 5/6) gravelly sand; single grain; about 25 percent pebbles; slight effervescence; moderately alkaline.

The solum ranges from 40 to 66 inches in thickness. It is strongly acid to neutral. The content of pebbles ranges from 0 to 25 percent throughout the solum.

The Ap has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The BE horizon has value of 4 or 5 and chroma of 2 or 3. The A and BE horizons are loam or sandy loam. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4, and chroma of 3 to 6. It is clay loam, sandy clay loam, sandy loam, loam, or the gravelly analogs of these textures. The 2C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sand, coarse sand, or gravelly sand.

Kingsville Series

The Kingsville series consists of poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope is 0 to 1 percent.

Kingsville soils are similar to Belleville soils and are commonly adjacent to Brems and Plainfield soils. Belleville soils are sandy in the upper part and loamy in the lower part. The moderately well drained Brems soils and the well drained Plainfield soils are in the higher positions on the landscape.

Typical pedon of Kingsville loamy sand, 408 feet north and 150 feet west of the southeast corner of sec. 26, T. 2 S., R. 17 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

Bg1—8 to 13 inches; dark grayish brown (2.5Y 4/2) sand; common medium distinct grayish brown (10YR 5/2) mottles; very weak medium granular structure; very friable; common fine roots; strongly acid; clear wavy boundary.

Bg2—13 to 30 inches; light brownish gray (2.5Y 6/2) sand; common medium faint pale brown (10YR 6/3) mottles; single grain; loose; few fine roots; medium acid; abrupt smooth boundary.

Cg1—30 to 45 inches; dark grayish brown (l0YR 4/2) and grayish brown (10YR 5/2) sand; single grain; loose; slightly acid; abrupt wavy boundary.

Cg2—45 to 60 inches; grayish brown (10YR 5/2) sand; single grain; loose; neutral.

The thickness of the solum ranges from 30 to 40 inches. Reaction is strongly acid or very strongly acid in the upper part of the solum and medium acid or slightly acid in the lower part. It ranges from medium acid to neutral in the C horizon.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly loamy sand, but the range includes sandy loam. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2.

Matherton Series

The Matherton series consists of somewhat poorly drained soils on outwash plains. These soils formed in loamy and sandy material. Permeability is moderate in the upper part of the pedon and rapid in the lower part. Slope is 0 to 2 percent.

These soils are more acid in the 2C horizon and have a lighter colored surface layer than is definitive for the Matherton series. These differences, however, do not alter the usefulness or behavior of the soils.

Matherton soils are commonly adjacent to Kalamazoo soils. The adjacent soils are well drained and are in the higher landscape positions.

Typical pedon of Matherton loam, 0 to 2 percent slopes, 1,052 feet north and 1,052 feet east of the center of sec. 33, T. 4 S., R. 14 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; friable; many fine roots; medium acid; abrupt smooth boundary.

Eg—9 to 13 inches; grayish brown (10YR 5/2) loam; few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine roots; slightly acid; clear smooth boundary.

B/E—13 to 17 inches; yellowish brown (10YR 5/6) loam (Bt); thin interfingers of brown (10YR 5/3) loam (E); brown (10YR 5/3) clay films on faces of peds; few fine faint dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; about 3 percent pebbles; slightly acid; gradual wavy boundary.

Btg—17 to 25 inches; grayish brown (10YR 5/2) sandy clay loam; many coarse prominent reddish brown (5YR 4/4) mottles; moderate medium subangular blocky structure; firm; slightly acid; clear wavy boundary.

2Cg—25 to 31 inches; grayish brown (10YR 5/2) loamy sand; many coarse prominent reddish brown (5YR 4/4) mottles; weak coarse crumb structure; friable; about 10 percent pebbles; strongly acid; gradual wavy boundary.

2C1—31 to 37 inches; pale brown (10YR 6/3) sand; single grain; loose; about 8 percent pebbles; medium acid; clear wavy boundary.

2C2—37 to 60 inches; yellowish brown (10YR 5/4) gravelly loamy sand; common medium distinct pale brown (10YR 6/3) mottles; weak medium crumb structure; about 15 percent pebbles; very friable; medium acid.

The solum ranges from 24 to 40 inches in thickness. It is strongly acid to neutral.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 5 or 6. The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is clay loam, sandy clay loam, or the gravelly analogs of these textures. The 2C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is gravelly loamy sand, gravelly sand, sand, or loamy sand.

Metea Series

The Metea series consists of well drained soils on moraines and till plains. These soils formed in sandy and loamy material. Permeability is rapid in the upper part of

the pedon and moderately slow in the lower part. Slope ranges from 1 to 12 percent.

Metea soils are commonly adjacent to Riddles, Selfridge, and Spinks soils. The fine-loamy Riddles soils and the sandy Spinks soils are in landscape positions similar to those of the Metea soils. Spinks soils have a discontinuous argillic horizon. Selfridge soils are somewhat poorly drained and are in the lower landscape positions.

Typical pedon of Metea loamy fine sand, 1 to 6 percent slopes, 150 feet south and 1,188 feet west of the northeast corner of sec. 30, T. 3 S., R. 16 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; very friable; common fine and medium roots; slightly acid; abrupt smooth boundary.

E1—10 to 16 inches; dark brown (10YR 4/3) fine sand; weak medium granular structure; loose; common fine roots; slightly acid; gradual smooth boundary.

E2—16 to 26 inches; yellowish brown (10YR 5/4) fine sand; weak medium granular structure; loose; common fine roots; slightly acid; abrupt wavy boundary.

Bt1—26 to 28 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; clay bridging between sand grains; slightly acid; abrupt wavy boundary.

2Bt2—28 to 36 inches; dark yellowish brown (10YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few fine roots; few thin dark brown (10YR 4/3) clay films; about 3 percent pebbles; neutral; abrupt wavy boundary.

2C1—36 to 39 inches; brownish yellow (10YR 6/6) silty clay loam; few fine distinct pale brown (10YR 6/3) mottles; massive; friable; few fine roots; moderately alkaline; abrupt broken boundary.

2C2—39 to 48 inches; dark yellowish brown (10YR 4/4) silty clay loam; massive; firm; many thick white (10YR 8/2) lime accumulations; strong effervescence; moderately alkaline; gradual wavy boundary.

2C3—48 to 60 inches; yellowish brown (10YR 5/6) silt loam; common medium prominent light brownish gray (10YR 6/2) mottles; massive; firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 34 to 40 inches. Reaction ranges from medium acid to neutral in the solum and from neutral to moderately alkaline in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4. It is dominantly loamy sand, but the range includes sand. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand or loamy sand. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is sandy loam, sandy clay loam, or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 8. It is silty clay loam, silt loam, or clay loam.

Morocco Series

The Morocco series consists of somewhat poorly drained, rapidly permeable soils on outwash plains and in glacial drainageways. These soils formed in sandy material. Slope is 0 to 2 percent.

Morocco soils are similar to Algansee and Brems soils and are commonly adjacent to Brems, Kingsville, Plainfield, and Spinks soils. Algansee soils are less acid and less stratified than the Morocco soils. They are on flood plains. The moderately well drained Brems soils, the excessively drained Plainfield soils, and the well drained Spinks soils are in the higher landscape positions. Spinks soils have a discontinuous argillic horizon. Kingsville soils are poorly drained and are in the lower landscape positions.

Typical pedon of Morocco loamy sand, 0 to 2 percent slopes, 2,118 feet south and 951 feet east of the northwest corner of sec. 35, T. 2 S., R. 14 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) loamy sand, brown (10YR 5/3) dry; single grain; loose; few fine roots; strongly acid; abrupt smooth boundary.

Bw1—9 to 19 inches; yellowish brown (10YR 5/6) sand; few fine distinct strong brown (7.5YR 5/8) mottles; single grain; loose; strongly acid; clear wavy boundary.

Bw2—19 to 30 inches; brownish yellow (10YR 6/6) sand; common medium prominent light gray (10YR 7/2) and common medium distinct strong brown (7.5YR 5/6) mottles; single grain; loose; strongly acid; clear wavy boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) sand; few fine distinct light brownish gray (10YR 6/2) mottles; single grain; loose; medium acid.

The solum ranges from 24 to 46 inches in thickness. It ranges from very strongly acid to medium acid in the upper part and is strongly acid or medium acid in the lower part.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is dominantly loamy sand, but the range includes fine sand and loamy fine sand. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sand or loamy sand. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 4. It is sand or fine sand.

Napoleon Series

The Napoleon series consists of very poorly drained, moderately permeable or moderately rapidly permeable soils in closed depressions. These soils formed in deposits of organic material more than 51 inches thick. Slope is 0 to 1 percent.

Napoleon soils are commonly adjacent to Kalamazoo, Oshtemo, and Spinks soils. The adjacent soils are well drained, are mineral, and are on uplands.

Typical pedon of Napoleon mucky peat, 2,640 feet north and 818 feet west of the southeast corner of sec. 23, T. 3 S., R. 16 W.

Oe1—0 to 16 inches; black (10YR 2/1), broken face and rubbed, mucky peat; about 35 percent fibers, 25 percent rubbed; weak medium platy structure; extremely acid; abrupt smooth boundary.

Oe2—16 to 60 inches; dark reddish brown (5YR 2/2), broken face, dark reddish brown (5YR 3/2), rubbed, hemic material; about 50 percent fibers, 30 percent rubbed; moderate thin to thick platy structure; extremely acid.

The organic material is 51 to more than 60 inches deep over mineral material. In some pedons 2 to 6 inches of sphagnum moss is on the surface. In some pedons 3 to 10 percent of the organic material is woody fragments that cannot be crushed between the fingers. The Oe horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 to 5, and chroma of 1 or 2.

Oakville Series

The Oakville series consists of well drained, rapidly permeable soils on beach ridges and dunes. These soils formed in sandy material. Slope ranges from 2 to 60 percent.

Oakville soils are similar to Plainfield soils and are commonly adjacent to Covert, Grattan, Kingsville, and Pipestone soils. The moderately well drained Covert, excessively drained Grattan, poorly drained Kingsville, and somewhat poorly drained Pipestone soils are in the lower landscape positions. Covert, Grattan, and Pipestone soils have a spodic horizon. Plainfield soils are coarser textured than the Oakville soils.

Typical pedon of Oakville fine sand, 25 to 60 percent slopes, 1,073 feet south and 83 feet east of the northwest corner of sec. 33, T. 1 S., R. 17 W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sand, light brownish gray (10YR 6/2) dry; single grain; loose; many medium and coarse roots; very strongly acid; clear wavy boundary.

EB—4 to 9 inches; brown (10YR 5/3) fine sand; single grain; loose; many medium and coarse roots; very strongly acid; gradual wavy boundary.

Bw1—9 to 20 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; many medium roots; strongly acid; gradual wavy boundary.

Bw2—20 to 32 inches; brownish yellow (10YR 6/6) fine sand; single grain; loose; few medium roots; strongly acid; gradual wavy boundary.

C—32 to 60 inches; very pale brown (10YR 7/4) fine sand; single grain; loose; strongly acid.

The thickness of the solum ranges from 18 to 40 inches. Reaction ranges from very strongly acid to slightly acid throughout the pedon.

The A horizon has value of 2 to 4 and chroma of 1 or 2. It is dominantly fine sand, but the range includes sand. The B horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 3 to 8. It is fine sand or sand. The C horizon also is fine sand or sand. It has value of 5 to 7 and chroma of 4 to 6.

Ormas Series

The Ormas series consists of well drained soils on outwash plains. These soils formed in sandy and loamy material. Permeability is moderately rapid in the solum and very rapid in the substratum. Slope ranges from 0 to 12 percent.

Ormas soils are similar to Oshtemo soils and are commonly adjacent to Oshtemo and Spinks soils. The adjacent soils are in landscape positions similar to those of the Ormas soils. Oshtemo soils are sandy loam within a depth of 20 inches. Spinks soils have a discontinuous argillic horizon.

Typical pedon of Ormas loamy sand, 0 to 6 percent slopes, 1,467 feet west and 2,580 feet south of the northeast corner of sec. 27, T. 2 S., R. 13 W.

Ap—0 to 6 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; neutral; abrupt smooth boundary.

E1—6 to 15 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; neutral; clear wavy boundary.

E2—15 to 40 inches; brownish yellow (10YR 6/6) sand; single grain; loose; neutral; clear wavy boundary.

2Bt1—40 to 48 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; very friable; clay bridging between sand grains; about 20 percent pebbles; neutral; abrupt irregular boundary.

2Bt2—48 to 55 inches; strong brown (7.5YR 4/6) gravelly sandy loam; single grain; friable; clay bridging between sand grains; about 20 percent pebbles; neutral; abrupt irregular boundary.

2C—55 to 60 inches; light yellowish brown (10YR 6/4) gravelly sand; single grain; loose; about 25 percent pebbles; slight effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 60 inches. The thickness of the upper sandy material ranges from 20 to 40 inches. Reaction is slightly acid or neutral in the Ap and E horizons and medium acid to mildly alkaline in the 2Bt horizon.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is dominantly loamy sand, but the range includes fine sand and sand. The E horizon has value of 4 to 6 and chroma of 3 to 6. It is loamy sand or sand. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 4 to 8. It is sandy loam, gravelly sandy loam, or sandy clay loam. The 2C horizon has hue of 10YR and 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is gravelly sand, gravelly loamy sand, or sand.

Oshtemo Series

The Oshtemo series consists of well drained soils on outwash plains. These soils formed in loamy and sandy material. Permeability is moderately rapid in the upper part of the pedon and rapid in the lower part. Slope ranges from 0 to 25 percent.

Oshtemo soils are similar to Bronson, Ormas, and Spinks soils and are commonly adjacent to Bronson and Spinks soils. Bronson soils are moderately well drained and are in the lower landscape positions. Ormas soils have a surface layer that is sandy and is thicker than that of the Oshtemo soils. Spinks soils have a discontinuous argillic horizon. They are in landscape positions similar to those of the Oshtemo soils.

Typical pedon of Oshtemo sandy loam, 0 to 6 percent slopes, 1,436 feet east and 452 feet south of the northwest corner of sec. 12, T. 3 S., R. 16 W.

Ap—0 to 11 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; very friable; very few fine roots; about 2 percent pebbles; strongly acid; abrupt wavy boundary.

E—11 to 19 inches; yellowish brown (10YR 5/6) loamy sand; weak medium subangular blocky structure; very friable; about 2 percent pebbles; strongly acid; clear wavy boundary.

Bt1—19 to 25 inches; strong brown (7.5YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; about 7 percent pebbles; medium acid; gradual wavy boundary.

Bt2—25 to 42 inches; strong brown (7.5YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; about 5 percent pebbles; medium acid; abrupt irregular boundary.

2C—42 to 60 inches; brownish yellow (10YR 6/6) gravelly sand; single grain; loose; about 25 percent pebbles; slight effervescence; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. It is strongly acid to slightly acid.

The Ap horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has chroma of 3 to 6. The A horizon is sandy loam or loamy sand. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 4 to 6. It is dominantly sandy loam, gravelly sandy loam, or sandy clay loam. In some pedons, however, the lower part of this horizon occurs as bands that are 1/8 inch to 3 inches thick and are separated by sand or loamy sand. Some pedons have a BC horizon. The 2C horizon has value of 5 or 6 and chroma of 4 to 6. It is sand or gravelly sand.

Ottokee Series

The Ottokee series consists of moderately well drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope is 0 to 3 percent.

Ottokee soils are commonly adjacent to Coloma and Thetford soils. Coloma soils are somewhat excessively drained and are in the higher landscape positions. Thetford soils are somewhat poorly drained, have more than 6 inches of bands, and are in the slightly lower landscape positions.

Typical pedon of Ottokee loamy fine sand, 0 to 3 percent slopes, 150 feet west and 2,166 feet south of the northeast corner of sec. 30, T. 2 S., R. 13 W.

Ap—0 to 10 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; moderate medium granular structure; very friable; many fine and few coarse roots; slightly acid; abrupt smooth boundary.

Bw1—10 to 26 inches; yellowish brown (10YR 5/6) loamy fine sand; single grain; loose; very few fine and few medium roots; slightly acid; gradual smooth boundary.

Bw2—26 to 36 inches; brownish yellow (10YR 6/6) fine sand; few fine prominent strong brown (7.5YR 5/8) mottles; single grain; loose; very few fine roots; slightly acid; gradual smooth boundary.

Bw3—36 to 50 inches; very pale brown (10YR 7/3) fine sand; common medium faint light brownish gray (10YR 6/2) and common medium distinct yellow (10YR 7/6) mottles; single grain; loose; slightly acid; gradual smooth boundary.

Bt&E—50 to 60 inches; lamellae of strong brown (7.5YR 5/8) loamy fine sand (Bt) and pale brown (10YR 6/3) fine sand (E); common medium faint light gray (10YR 7/2) mottles; single grain; loose; clay bridging between sand grains (Bt); slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. Reaction ranges from medium acid to neutral throughout the pedon. The depth to the lamellae ranges from 36 to 55 inches. The lamellae are 1/4 inch to 2 inches thick.

The A horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes sand and fine sand. The Bw horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 to 6. It is loamy sand, fine sand, or sand. The Bt part of the Bt&E horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 4 to 8. It is loamy sand or loamy fine sand. The C horizon, if it occurs, has value of 5 or 6 and chroma of 2 or 3. It is sand or fine sand.

Palms Series

The Palms series consists of very poorly drained soils in old lakebeds. These soils formed in deposits of organic material 16 to 50 inches deep over loamy deposits. Permeability is moderately slow to moderately rapid in the organic material and moderately slow or moderate in the loamy material. Slope is 0 to 1 percent.

Palms soils are similar to Adrian, Edwards, and Houghton soils and are commonly adjacent to those soils. Adrian soils are organic to a depth of 16 to 50 inches and are underlain by sand. Edwards soils are organic to a depth of 16 to 50 inches and are underlain by marl. Houghton soils are organic to a depth of more than 51 inches.

Typical pedon of Palms muck, 1,320 feet south and 231 feet west of the center of sec. 22, T. 3 S., R. 15 W.

Oa1—0 to 18 inches; dark brown (7.5YR 3/2), broken face, sapric material, very dark gray (10YR 3/1) rubbed; weak medium subangular blocky structure; very friable; many roots; neutral; gradual smooth boundary.

Oa2—18 to 24 inches; dark reddish brown (5YR 3/3), broken face, sapric material, dark reddish brown (5YR 3/2) rubbed; weak medium subangular blocky structure; very friable; many roots; neutral; abrupt smooth boundary.

Cg1—24 to 32 inches; very dark grayish brown (2.5Y 3/2) sandy loam; massive; few roots; many very dark gray (10YR 3/1) organic stains; neutral; abrupt smooth boundary.

Cg2—32 to 48 inches; gray (10YR 5/1) silt loam; massive; few roots; common very dark gray (10YR 3/1) organic stains; slight effervescence; moderately alkaline; gradual smooth boundary.

Cg3—48 to 60 inches; gray (10YR 5/1) fine sandy loam that has thin strata of silt loam; massive; common very dark gray (10YR 3/1) organic stains; slight effervescence; moderately alkaline.

The organic material is 16 to 50 inches deep over loamy material. It ranges from strongly acid to mildly alkaline.

The surface tier has hue of 10YR or 7.5YR or is neutral in hue. It has chroma of 0 to 2. It is dominantly sapric material, but the range includes hemic material. The subsurface and lower tiers have hue of 10YR, 7.5YR, or 5YR or are neutral in hue. They have value of 2 to 4 and chroma of 0 to 3. Some pedons have layers of hemic material 4 to 7 inches thick.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 6, and chroma of 1 or 2. It is dominantly silty clay loam, clay loam, sandy loam, fine sandy loam, or silt loam. In some pedons, however, it has strata of loamy sand, silt loam, sandy clay loam, or sand.

Pewamo Series

The Pewamo series consists of poorly drained, moderately slowly permeable soils on till plains. These soils formed in clayey and loamy material. Slope is 0 to 1 percent.

Pewamo soils are similar to Blount soils and are commonly adjacent to Blount and Capac soils. The adjacent soils are in the higher landscape positions. Blount soils are somewhat poorly drained. Capac soils are fine-loamy.

Typical pedon of Pewamo silty clay loam, 249 feet south and 84 feet west of the northeast corner of sec. 1, T. 3 S., R. 15 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate medium granular structure; friable; about 3 percent pebbles; few very fine roots; neutral; abrupt smooth boundary.

Btg1—11 to 17 inches; dark gray (10YR 4/1) silty clay loam; common medium distinct dark yellowish brown (10YR 4/4) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; about 2 percent pebbles; few thin continuous clay films on faces of peds; few very fine roots; mildly alkaline; clear wavy boundary.

Btg2—17 to 36 inches; grayish brown (10YR 5/2) silty clay; many medium prominent yellowish brown (10YR 5/6) mottles; coarse medium subangular blocky structure; firm; about 3 percent pebbles; common thin continuous clay films on faces of peds; few very fine roots; mildly alkaline; gradual wavy boundary.

Cg1—36 to 45 inches; dark grayish brown (10YR 4/2) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; very firm; about 2 percent pebbles; strong effervescence; mildly alkaline; gradual wavy boundary.

Cg2—45 to 60 inches; dark gray (10YR 4/1) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; massive; very firm; about 2 percent pebbles; violent effervescence; moderately alkaline.

The solum ranges from 28 to 42 inches in thickness. It is slightly acid or neutral in the upper part and medium acid to mildly alkaline in the lower part.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay, silty clay loam, or clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam or silty clay loam.

Pipestone Series

The Pipestone series consists of somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope is 0 to 3 percent.

Pipestone soils are similar to Covert soils and are commonly adjacent to Covert, Grattan, Kingsville, Oakville, and Selfridge soils. The moderately well drained Covert soils, the excessively drained Grattan soils, and the well drained Oakville soils are in the higher landscape positions. Oakville, Kingsville, and Selfridge soils do not have a spodic horizon. Kingsville soils are poorly drained and are in the lower landscape positions. Selfridge soils are sandy in the upper part and loamy in the lower part. They are in landscape positions similar to those of the Pipestone soils.

Typical pedon of Pipestone fine sand, in an area of Pipestone-Kingsville complex, 0 to 3 percent slopes, 1,938 feet east and 2,544 feet south of the northwest corner of sec. 9, T. 2 S., T. 17 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sand, grayish brown (10YR 5/2) dry; very weak medium granular structure; very friable; many fine roots; strongly acid; abrupt smooth boundary.

E—9 to 14 inches; grayish brown (10YR 5/2) fine sand; common medium distinct dark grayish brown (10YR 4/2) mottles; very weak medium granular structure; very friable; few fine roots; medium acid; abrupt wavy boundary.

Bhs1—14 to 17 inches; dark brown (7.5YR 3/2) fine sand; common fine distinct dark grayish brown (10YR 4/2) and few medium prominent red (2.5YR 4/6) mottles; weak medium subangular blocky structure; very friable; few fine roots; medium acid; clear wavy boundary.

Bhs2—17 to 22 inches; dark reddish brown (5YR 3/2) fine sand; common medium distinct dark brown (7.5YR 3/2) mottles; moderate medium angular blocky structure; friable; few fine roots; medium acid; clear wavy boundary.

Bs—22 to 26 inches; dark reddish brown (5YR 3/4) sand; common medium distinct brown (7.5YR 4/4) and dark brown (7.5YR 3/2) mottles; very weak medium angular blocky structure; very friable; few fine roots; medium acid; clear wavy boundary.

C—26 to 60 inches; yellowish brown (10YR 5/4) fine sand; common medium distinct brown (7.5YR 4/2) mottles; single grain; loose; about 5 percent pebbles; medium acid.

The thickness of the solum ranges from 25 to 48 inches. Reaction ranges from very strongly acid to slightly acid in the solum and from strongly acid to neutral in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly fine sand, but the range includes loamy sand. The E horizon has value of 5 or 6 and chroma of 1 or 2. The Bhs horizon has hue of 5YR, 7.5YR, or 10YR and value and chroma of 2 or 3. It is sand or fine sand. The C horizon also is sand or fine sand. It has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 6.

Plainfield Series

The Plainfield series consists of excessively drained, rapidly permeable soils on moraines and outwash plains. These soils formed in sandy material. Slope ranges from 0 to 12 percent.

Plainfield soils are similar to Brems, Coloma, Grattan, and Oakville soils and are commonly adjacent to Brems, Coloma, and Morocco soils. Brems soils are moderately well drained and are in the slightly lower landscape positions. Coloma soils have textural bands. They are in landscape positions similar to those of the Plainfield soils. Grattan soils have a spodic horizon. Morocco soils are somewhat poorly drained and are in the lower landscape positions. Oakville soils are finer textured than the Plainfield soils.

Typical pedon of Plainfield sand, 0 to 6 percent slopes, 3,300 feet north and 1,320 feet east of the southwest corner of sec. 21, T. 3 S., R. 13 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) sand, brown (10YR 5/3) dry; weak medium granular structure; very friable; common fine, medium, and coarse roots; medium acid; abrupt smooth boundary.

Bw1—9 to 20 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; strongly acid; gradual smooth boundary.

C1—20 to 46 inches; yellowish brown (10YR 5/6) sand; single grain; loose; strongly acid; diffuse smooth boundary.

C2—46 to 60 inches; brownish yellow (10YR 6/6) sand; single grain; loose; medium acid.

The thickness of the solum ranges from 18 to 34 inches. Reaction ranges from strongly acid to neutral throughout the pedon.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. The C horizon has value of 5 to 7 and chroma of 4 to 6.

Riddles Series

The Riddles series consists of well drained, moderately permeable soils on moraines. These soils formed in loamy material. Slope ranges from 1 to 25 percent.

Riddles soils are similar to Tuscola soils and are commonly adjacent to Capac, Metea, and Spinks soils. Capac soils are somewhat poorly drained and are in the lower landscape positions. Metea soils formed in sandy material over loamy material. They are in landscape positions similar to those of the Riddles soils. Spinks soils are sandy and have a discontinuous argillic horizon. They are in landscape positions similar to those of the Riddles soils. Tuscola soils are moderately well drained and are stratified.

Typical pedon of Riddles sandy loam, 1 to 6 percent slopes, 603 feet east and 1,392 feet south of the northwest corner of sec. 10, T. 4 S., R. 16 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; about 5 percent pebbles; strongly acid; abrupt smooth boundary.

E—8 to 17 inches; brown (10YR 5/3) clay loam; common medium distinct dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; firm; many fine roots; about 5 percent pebbles; slightly acid; clear wavy boundary.

Bt1—17 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; few thin yellowish brown (10YR 5/6) clay films; about 5 percent pebbles and 1 percent cobbles; medium acid; gradual wavy boundary.

Bt2—30 to 45 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; few thin yellowish brown (10YR 5/6) clay films; about 5 percent pebbles; medium acid; gradual wavy boundary.

BC—45 to 60 inches; dark yellowish brown (10YR 4/4) clay loam; massive; firm; about 5 percent pebbles; medium acid.

The solum ranges from 40 to more than 70 inches in thickness. It is strongly acid to neutral. The content of pebbles and cobbles ranges from 1 to 8 percent throughout the solum.

The Ap horizon has value of 3 or 4. It is dominantly sandy loam, but the range includes loam. The E horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or sandy loam. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam or sandy clay loam. In some pedons, however, it has subhorizons of silty clay loam or loam. Some pedons have a C horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is dominantly loam, clay loam, or sandy loam. In some pedons, however, it has pockets or strata of sand or loamy sand.

Selfridge Series

The Selfridge series consists of somewhat poorly drained soils on till plains and lake plains. These soils formed in sandy and loamy material. Permeability is rapid in the sandy material and moderately slow in the loamy material. Slope is 0 to 3 percent.

These soils are taxadjuncts to the Selfridge series because they do not have mottles with low chroma in the upper 30 inches and have a Bt horizon that is thinner than is definitive for the series. These differences, however, do not alter the usefulness or behavior of the soils.

Selfridge soils are similar to Thetford soils and commonly adjacent to Kingsville, Metea, Pipestone, and Riddles soils. Kingsville soils are sandy and are poorly drained. They are in the lower landscape positions. Metea and Riddles soils are well drained and are in the higher landscape positions. Riddles soils are loamy throughout. Pipestone soils are sandy and have a spodic horizon. They are in landscape positions similar to those of the Selfridge soils. Thetford soils have textural bands throughout.

Typical pedon of Selfridge loamy sand, 0 to 3 percent slopes, 1,568 feet east and 1,707 feet north of the southwest corner of sec. 10, T. 3 S., R. 16 W.

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) loamy sand, pale brown (10YR 6/3) dry; moderate medium granular structure; about 2 percent pebbles; very friable; very few fine roots; medium acid; abrupt smooth boundary.

E1—12 to 18 inches; yellowish brown (10YR 5/6) sand; few fine faint pale brown (10YR 6/3) mottles; single grain; about 2 percent pebbles; loose; medium acid; gradual wavy boundary.

E2—18 to 25 inches; yellowish brown (10YR 5/6) sand; few fine distinct strong brown (7.5YR 4/6) and common medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; slightly acid; gradual wavy boundary.

E3—25 to 33 inches; reddish yellow (5YR 6/6) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; slightly acid; abrupt smooth boundary.

Bt1—33 to 35 inches; brown (7.5YR 4/4) sandy loam; common medium faint dark yellowish brown (10YR 4/4) and few medium distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; about 2 percent pebbles; friable; neutral; gradual wavy boundary.

2Bt2—35 to 38 inches; brown (10YR 5/3) clay loam; common medium distinct light olive gray (5Y 6/2) and common coarse distinct yellowish brown (10YR 5/8) mottles; strong coarse subangular blocky structure; firm; light gray (10YR 7/1) lime concretions; common thin brown (10YR 5/3) clay films; mildly alkaline; gradual wavy boundary.
2C1—38 to 48 inches; brown (10YR 5/3) silty clay loam; few fine faint gray (10YR 6/1) and common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; slight effervescence; mildly alkaline; gradual wavy boundary.
2C2—48 to 60 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few fine prominent gray (10YR 6/1) mottles; massive; very firm; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. It ranges from medium acid to mildly alkaline.

The Ap horizon has chroma of 1 or 2. It is dominantly loamy sand, but the range includes fine sand. The E horizon has value of 5 or 6 and chroma of 2 to 6. It is sand or loamy sand. The Bt horizon has hue or 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam or loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 1 to 3. It is silty clay loam, sandy clay loam, or clay loam. The 2C horizon has chroma of 1 to 3. It is clay loam, silty clay loam, or loam.

Sloan Series

The Sloan series consists of very poorly drained, moderately permeable or moderately slowly permeable soils on flood plains. These soils formed in loamy alluvium. Slope is 0 to 1 percent.

Sloan soils are commonly adjacent to Algansee, Cohoctah, and Houghton soils. Algansee soils are sandy, are somewhat poorly drained, and are on slight rises on the flood plains. Cohoctah and Houghton soils are in landscape positions similar to those of the Sloan soils. Cohoctah soils are coarse-loamy. Houghton soils are muck throughout.

Typical pedon of Sloan loam, 57 feet east and 1,914 feet south of the northwest corner of sec. 19, T. 2 S., R. 14 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; firm; few fine and medium roots; few fine black (10YR 2/1) organic stains; slightly acid; abrupt wavy boundary.
Bg1—10 to 18 inches; grayish brown (10YR 5/2) clay loam; common medium prominent strong brown (7.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; firm; few fine black (2.5Y 2/0) and few medium gray (10YR 5/1) organic stains; neutral; gradual smooth boundary.
Bg2—18 to 34 inches; gray (10YR 5/1) clay loam; few medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few medium very dark gray (10YR 3/1) and few fine dark gray (10YR 4/1) organic stains; neutral; gradual smooth boundary.
Bg3—34 to 50 inches; gray (5Y 5/1) clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; firm; few medium gray (10YR 5/1) and few fine black (10YR 2/1) organic stains; neutral; gradual wavy boundary.
Cg—50 to 60 inches; gray (10YR 6/1) stratified silt loam and silty clay loam; common medium and coarse prominent light olive brown (2.5Y 5/6) mottles; massive; very firm; strong effervescence; mildly alkaline.

The solum ranges from 20 to 55 inches in thickness. It ranges from slightly acid to mildly alkaline in the upper part and from neutral to moderately alkaline in the lower part.

The A horizon has chroma of 2 or 3. It is dominantly loam, but the range includes silty clay loam and silt loam. The Bg horizon has hue of 10YR or 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. It is silty clay loam or clay loam. The C horizon has hue of 2.5Y, 5Y, 5GY or is neutral in hue. It has value of 4 to 6 and chroma of 0 to 2. It is dominantly stratified very fine sandy loam, silt loam, and silty clay loam. In some pedons, however, it has some thin strata of very fine sand.

Spinks Series

The Spinks series consists of well drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy and loamy material. Slope ranges from 0 to 12 percent.

Spinks soils are similar to Coloma and Oshtemo soils and are commonly adjacent to Ormas, Oshtemo, and Thetford soils. Coloma soils have less than 6 inches of bands. Ormas and Oshtemo soils have a continuous argillic horizon. They are in landscape positions similar to those of the Spinks soils. Thetford soils are somewhat poorly drained and are in the lower landscape positions.

Typical pedon of Spinks loamy sand, 0 to 6 percent slopes, 594 feet south and 114 feet east of the northwest corner of sec. 30, T. 4 S., R. 14 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; strongly acid; abrupt smooth boundary.

E1—9 to 19 inches; dark yellowish brown (10YR 4/6) loamy sand; single grain; loose; medium acid; gradual wavy boundary.

E2—19 to 30 inches; yellowish brown (10YR 5/6) sand; single grain; loose; medium acid; clear smooth boundary.

E&Bt—30 to 60 inches; light yellowish brown (10YR 6/4) sand (E); single grain; loose; lamellae of dark brown (7.5YR 4/4) loamy sand (Bt); weak medium crumb structure; very friable; medium acid.

The solum ranges from 36 to more than 60 inches in thickness. It is dominantly medium acid to neutral. In some pedons, however, the A horizon is strongly acid.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is dominantly loamy sand, but the range includes fine sand. The E horizon has value of 4 to 6 and chroma of 3 to 6. It is sand, fine sand, or loamy sand. The B horizon occurs as lamellae 1/4 inch to 4 inches thick. The total thickness is more than 6 inches. This horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand or sandy loam. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is sand or fine sand.

Thetford Series

The Thetford series consists of somewhat poorly drained, moderately rapidly permeable soils on outwash plains. These soils formed in sandy material. Slope is 0 to 2 percent.

These soils have a more acid solum than is definitive for the Thetford series. This difference, however, does not alter the usefulness or behavior of the soils.

Thetford soils are similar to Selfridge soils and are commonly adjacent to Gilford, Kingsville, and Spinks soils. Gilford and Kingsville soils are poorly drained and are in the lower landscape positions. Gilford soils have more clay in the upper part of the solum than the Thetford soils. Kingsville soils do not have textural bands. Selfridge soils formed in sandy material over loamy material. Spinks soils are well drained and are in the higher landscape positions.

Typical pedon of Thetford loamy sand, 0 to 2 percent slopes, 1,989 feet west and 2,874 feet north of the southeast corner of sec. 28, T. 2 S., R. 13 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; common fine and very few medium roots; strongly acid; abrupt smooth boundary.

E—9 to 11 inches; yellowish brown (10YR 5/6) loamy sand; common medium faint yellowish brown (10YR 5/4) mottles; moderate medium granular structure; very friable; few fine roots; about 2 percent pebbles; strongly acid; abrupt wavy boundary.

E&Bt—11 to 45 inches; light yellowish brown (10YR 6/4) sand (E); common fine faint grayish brown (10YR 5/2) and common coarse distinct light gray (10YR 7/2) mottles; single grain; loose; discontinuous yellowish brown (10YR 5/6) loamy sand bands (Bt); common fine prominent strong brown (7.5YR 4/6) mottles; weak medium granular structure; very friable; clay bridging between sand grains; common fine roots; about 2 percent pebbles; strongly acid; clear wavy boundary.

C—45 to 60 inches; light yellowish brown (10YR 6/4) sand; common medium distinct light gray (10YR 7/2) and few fine distinct yellowish brown (10YR 5/6) mottles; single grain; loose; about 3 percent pebbles; strongly acid.

The thickness of the solum ranges from 40 to more than 60 inches. Reaction ranges from strongly acid to slightly acid throughout the pedon. The content of pebbles is 0 to 4 percent in the lower part of the solum.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is dominantly loamy sand, but the range includes fine sand. The E horizon has value of 4 to 6 and chroma of 3 to 6. It is loamy sand or fine sand. The E part of the E&Bt horizon has value of 4 to 6 and chroma of 3 or 4. It is sand or loamy sand. The Bt part has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand, loamy fine sand, or sandy loam. It occurs as lamellae 1/4 inch to 3 inches thick. The total thickness of the lamellae is 6 to more than 9 inches.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. It is sand, very fine sand, or coarse sand. The content of coarse fragments ranges from 0 to 5 percent.

Tuscola Series

The Tuscola series consists of moderately well drained, moderately permeable soils on outwash plains and lake plains. These soils formed in stratified loamy material. Slope ranges from 0 to 4 percent.

Tuscola soils are similar to Riddles soils and are commonly adjacent to Colwood soils. Colwood soils are poorly drained and in the lower landscape positions. Riddles soils are well drained and are not stratified.

Typical pedon of Tuscola silt loam, 0 to 4 percent slopes, 15 feet west and 2,135 feet south of the northeast corner of sec. 30, T. 3 S., R. 16 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; friable; very few fine roots; neutral; abrupt smooth boundary.

E—9 to 14 inches; yellowish brown (10YR 5/4) silt loam; common medium faint yellowish brown (10YR 5/6) and common medium distinct dark yellowish brown

(10YR 4/6) mottles; moderate medium subangular blocky structure; firm; neutral; clear wavy boundary.

Bt1—14 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and common medium faint brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; few thin dark yellowish brown (10YR 4/4) clay films; few black (10YR 2/1) iron stains; neutral; gradual wavy boundary.

Bt2—21 to 30 inches; dark brown (10YR 4/3) silty clay loam; common medium faint grayish brown (10YR 5/2) and few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few moderately thick dark brown (10YR 4/3) clay films; neutral; gradual wavy boundary.

C—30 to 60 inches; brown (10YR 5/3) stratified silty clay loam and silt loam; common medium faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; massive; firm; few thin white (10YR 8/2) lime accumulations; slight effervescence; mildly alkaline.

The solum ranges from 30 to 50 inches in thickness. It is dominantly medium acid to neutral. In some pedons, however, the lower part of the B horizon is slightly acid to mildly alkaline.

The Ap horizon has value of 3 or 4 and chroma of 2 or 4. It is dominantly silt loam, but the range includes sandy loam. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. It is dominantly silty clay loam, clay loam, or silt loam. In most pedons, however, it has strata of silt and very fine sand 1/4 to 1 inch thick. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is silt loam and silty clay loam and has strata of very fine sand and silt 1/4 inch to 3 inches thick.

Formation of the Soils

The paragraphs that follow relate the factors of soil formation to the soils in Van Buren County and explain the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material (*4*).

Climate and plant and animal life are the active forces in soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material, the unconsolidated mass in which a soil forms, determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils of Van Buren County were deposited by glaciers or by glacial meltwater. The glaciers covered the county 10,000 to 12,000 years ago. Some of these materials have been reworked and redeposited by the subsequent action of water and wind. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Van Buren County were deposited as glacial till, outwash, lacustrine material, alluvium, and organic material.

Glacial till was deposited directly by-glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. In most areas the glacial till in Van Buren County is calcareous loam, clay loam, or sandy loam. Capac soils are an example of soils that formed in glacial till. They typically are moderately fine textured and have a well developed subsoil.

Outwash material was deposited by running water from melting glaciers. The size of the particles varies according to the speed of the stream that carried them. As the speed of the stream decreased, the coarser particles were deposited. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as sandy loam, sand, gravel, and other coarse particles. Oshtemo soils are an example of soils that formed in deposits of outwash.

Lacustrine material was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of the moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. In Van Buren County, the soils that formed in lacustrine deposits typically are medium textured, moderately fine textured, and fine textured. Colwood soils are an example.

Alluvium is material recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. Sloan and Cohoctah soils are examples of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers receded, water was left standing in depressions in the outwash plains, flood plains, moraines, and till plains. Because of the wetness, the grasses, sedges, and water-tolerant plants that grew around the edges of these depressions did not decompose quickly after they died. Eventually, the plant residue filled the depressions and decomposed to form muck. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Green plants have been the principal organisms that have influenced soil formation in Van Buren County. Bacteria, fungi, earthworms, and human activities also have been important. The chief contribution of plant and animal life is the addition of organic matter and nitrogen

to the soil. The kind of organic material in the soil depends on the kinds of plants that grew on the soil in the past. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria in the soil help to break down the organic matter into plant nutrients.

The native vegetation in Van Buren County was mainly deciduous trees, but conifers grew on the sandy soils. Differences in natural soil drainage and minor variations in the parent material affected the composition of the forest species. The well drained upland soils, such as Riddles and Oshtemo soils, were covered mainly by sugar maple, oak, and beech. The poorly drained and very poorly drained soils were covered by soft maple, elm, and ash. Examples are Colwood and Pewamo soils, which contain a considerable amount of organic matter.

Climate

Climate determines the kind of plant and animal life on and in the soil and the amount of water available for the weathering of minerals and for the transporting of soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil.

The climate in Van Buren County, which is presumably similar to that under which the soils formed, is cool and humid. It is uniform in all areas throughout the county, except for those along the shoreline of Lake Michigan. Differences in climate account for only minor differences among the soils in the county.

Relief

Relief affects the natural drainage of soils, the rate of erosion, the kind of plant cover, and the soil temperature. Slopes range from 0 to 60 percent in Van Buren County. Runoff is most rapid on the steeper slopes. In low areas water is temporarily ponded.

The soils in the county range from excessively drained on some ridgetops to very poorly drained in some depressions. Through its effect on soil aeration, drainage partly determines the color of the soil. Water and air move freely through well drained soils and slowly through very poorly drained soils. In Grattan and other well aerated soils, the iron and aluminum compounds are brightly colored and oxidized. Colwood and other poorly aerated soils are dull gray and mottled.

Time

Generally, a long time is needed for the development of distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Van Buren County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the development of distinct horizons. The soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct horizons. Cohoctah soils are an example of young alluvial soils. Riddles soils are an example of mature soils. Their horizons are distinct, and lime has been leached from their solum.

Processes of Soil Formation

The processes responsible for the development of the soil horizons in the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the horizons are referred to as soil morphology.

Several processes were involved in the development of horizons in the soils of Van Buren County—the accumulation of organic matter, the leaching of lime (calcium carbonate) and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes have been active in the development of horizons.

As organic matter accumulates at the surface of a soil, an A horizon forms. If the soil is plowed, this horizon is mixed into the plow layer, or Ap horizon. In the soils in Van Buren County, the surface layer ranges from high to low in content of organic matter. Kalamazoo soils are an example of soils that have a high content of organic matter in the surface layer. Spinks soils are an example of soils that have a low content of organic matter.

The leaching of carbonates and other bases has occurred in most of the soils. The leaching of bases generally precedes the translocation of silicate clay minerals. Many of the soils in Van Buren County are moderately leached or strongly leached. For example, Riddles soils are leached of carbonates to a depth of 60 inches and Capac soils are generally leached to a depth of 40 inches. This difference in the depth of leaching is a result of time, relief, and parent material.

Gleying, or the reduction and transfer of iron, is evident in somewhat poorly drained, poorly drained, and very poorly drained soils. The gray subsoil in these soils indicates the reduction and transfer of iron. Pewamo soils are an example of strongly gleyed soils.

The translocation of clay minerals contributes to horizon development. An eluviated, or leached, E horizon is lower in content of clay than an illuviated B horizon and typically is lighter in color. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. Soils at this stage of formation probably were leached of carbonates and soluble salts to a considerable extent before the silicate clays were translocated. Riddles soils are an example.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated

compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are

commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced

by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Pressurized sewage disposal system. A system of evenly distributing secondary effluent from a holding tank to a stone-filled filter bed. The effluent is distributed under low pressure through small-diameter subsurface pipes that have small, evenly spaced holes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be

easily increased in density and bearing properties by *compaction*. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-80 at Bloomingdale, Michigan. Data from 2 years have been omitted]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	30.2	15.7	22.9	53	-11	0	2.78	1.6	3.8	8	28.5
February---	33.9	16.4	25.1	56	-11	0	1.92	1.1	2.7	6	14.7
March------	43.6	24.7	34.1	74	-1	11	2.82	1.8	3.7	8	9.4
April------	58.6	36.0	47.3	84	14	98	3.69	2.7	4.6	8	2.9
May--------	70.7	46.0	58.3	90	27	295	3.13	1.9	4.3	7	**
June-------	79.0	54.9	67.0	94	36	517	3.96	2.4	5.3	7	.0
July-------	83.0	58.8	70.9	95	42	655	3.61	2.2	4.9	6	.0
August-----	81.3	57.5	69.4	95	41	611	3.34	1.9	4.6	6	.0
September--	74.4	50.8	62.6	93	32	389	3.58	1.5	5.4	6	.0
October----	62.6	40.7	51.7	84	22	148	3.03	1.4	4.5	6	1.4
November---	47.7	31.3	39.5	74	10	2	3.18	2.1	4.1	8	9.8
December---	35.2	21.2	28.2	60	-5	0	3.24	1.9	4.4	9	24.7
Year-----	58.3	37.8	48.1	97	-14	2,726	38.28	33.1	43.2	86	91.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

** Trace.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1930-79 at Bloomingdale, Michigan]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 27	May 10	May 26
2 years in 10 later than--	Apr. 21	May 4	May 20
5 years in 10 later than--	Apr. 11	Apr. 26	May 10
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 18	Oct. 10	Sept. 24
2 years in 10 earlier than--	Oct. 25	Oct. 15	Sept. 28
5 years in 10 earlier than--	Nov. 6	Oct. 24	Oct. 8

TABLE 3.--GROWING SEASON

[Recorded in the period 1930-79 at Bloomingdale, Michigan]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	180	162	130
8 years in 10	190	169	137
5 years in 10	208	181	151
2 years in 10	226	193	165
1 year in 10	235	200	172

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
3B	Coloma loamy sand, 0 to 6 percent slopes	22,948	5.6
3C	Coloma loamy sand, 6 to 12 percent slopes	8,384	2.1
4B	Blount silt loam, 0 to 4 percent slopes	7,031	1.8
6B	Oshtemo sandy loam, 0 to 6 percent slopes	17,022	4.3
6C	Oshtemo sandy loam, 6 to 12 percent slopes	5,477	1.4
6D	Oshtemo-Coloma loamy sands, 12 to 18 percent slopes	7,070	1.8
6E	Oshtemo-Coloma loamy sands, 18 to 25 percent slopes	3,459	0.9
7	Glendora sandy loam	5,104	1.3
8A	Morocco loamy sand, 0 to 2 percent slopes	5,339	1.3
9B	Plainfield sand, 0 to 6 percent slopes	10,596	2.7
9C	Plainfield sand, 6 to 12 percent slopes	1,623	0.4
10	Aquents and Histosols, ponded	4,345	1.1
11	Edwards muck	3,459	0.9
12B	Spinks-Oshtemo complex, 0 to 6 percent slopes	8,725	2.2
12C	Spinks-Oshtemo complex, 6 to 12 percent slopes	4,421	1.1
17A	Brems sand, 0 to 2 percent slopes	7,902	2.0
18B	Ormas loamy sand, 0 to 6 percent slopes	4,100	1.0
18C	Ormas loamy sand, 6 to 12 percent slopes	950	0.2
19A	Ottokee loamy fine sand, 0 to 3 percent slopes	5,004	1.3
20B	Spinks loamy sand, 0 to 6 percent slopes	21,532	5.4
20C	Spinks loamy sand, 6 to 12 percent slopes	5,835	1.5
22A	Kalamazoo loam, 0 to 2 percent slopes	5,012	1.3
22B	Kalamazoo loam, 2 to 6 percent slopes	10,261	2.6
22C	Kalamazoo loam, 6 to 12 percent slopes	3,840	1.0
24A	Bronson sandy loam, 0 to 3 percent slopes	6,170	1.5
26	Gilford sandy loam	14,913	3.5
27	Adrian muck	12,772	3.2
28	Houghton muck	17,456	4.4
32	Colwood silt loam	8,862	2.2
33B	Tuscola silt loam, 0 to 4 percent slopes	4,677	1.2
36C	Oakville fine sand, 2 to 12 percent slopes	1,853	0.5
36D	Oakville fine sand, 12 to 25 percent slopes	1,464	0.4
36E	Oakville fine sand, 25 to 60 percent slopes	2,457	0.6
37A	Thetford loamy sand, 0 to 2 percent slopes	8,920	2.2
38	Napoleon mucky peat	2,298	0.6
39A	Matherton loam, 0 to 2 percent slopes	3,026	0.8
43	Sloan loam	4,617	1.2
45B	Covert sand, 0 to 4 percent slopes	3,944	1.0
47A	Selfridge loamy sand, 0 to 3 percent slopes	22,017	5.5
48A	Pipestone-Kingsville complex, 0 to 3 percent slopes	13,047	3.3
49B	Grattan sand, 0 to 6 percent slopes	1,427	0.4
50B	Metea loamy fine sand, 1 to 6 percent slopes	7,680	1.9
50C	Metea loamy fine sand, 6 to 12 percent slopes	1,176	0.3
51	Kingsville loamy sand	11,173	2.8
52B	Riddles sandy loam, 1 to 6 percent slopes	13,144	3.3
52C	Riddles sandy loam, 6 to 12 percent slopes	3,751	0.9
52D	Riddles sandy loam, 12 to 18 percent slopes	1,254	0.3
52E	Riddles sandy loam, 18 to 25 percent slopes	414	0.1
53B	Capac loam, 1 to 5 percent slopes	20,420	5.1
54	Palms muck	2,168	0.5
56	Pewamo silty clay loam	2,137	0.5
60	Belleville loamy sand	2,989	0.7
61B	Udipsamments and Udorthents, 0 to 4 percent slopes	1,007	0.3
62	Pits	647	0.2
64B	Urban land-Coloma complex, 0 to 6 percent slopes	1,371	0.3
65B	Urban land-Brems complex, 0 to 4 percent slopes	332	0.1
66	Algansee-Cohoctah complex	8,913	2.2
	Water areas less than 40 acres in size	3,361	0.8
	Water areas more than 40 acres in size	8,000	2.0
	Total	399,296	100.0

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
4B	Blount silt loam, 0 to 4 percent slopes (where drained)
6B	Oshtemo sandy loam, 0 to 6 percent slopes
22A	Kalamazoo loam, 0 to 2 percent slopes
22B	Kalamazoo loam, 2 to 6 percent slopes
24A	Bronson sandy loam, 0 to 3 percent slopes
32	Colwood silt loam (where drained)
33B	Tuscola silt loam, 0 to 4 percent slopes
39A	Matherton loam, 0 to 2 percent slopes (where drained)
47A	Selfridge loamy sand, 0 to 3 percent slopes
50B	Metea loamy fine sand, 1 to 6 percent slopes
52B	Riddles sandy loam, 1 to 6 percent slopes
53B	Capac loam, 1 to 5 percent slopes (where drained)
56	Pewamo silty clay loam (where drained)
60	Belleville loamy sand (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability		Corn		Oats		Winter wheat		Soybeans		Grass-legume hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
3B----------------Coloma	IVs	IIIe	45	170	45	---	---	---	18	55	2.5	---
3C----------------Coloma	IVs	---	---	---	---	---	---	---	---	---	---	---
4B----------------Blount	IIw	---	106	---	64	---	48	---	35	---	4.3	---
6B----------------Oshtemo	IIIs	IIIs	95	175	80	---	45	---	30	57	2.5	8.0
6C----------------Oshtemo	IIIe	IIIe	90	165	75	---	40	---	26	50	2.5	7.0
6D----------------Oshtemo-Coloma	VIe	---	---	---	---	---	---	---	---	---	---	---
6E----------------Oshtemo-Coloma	VIIe	---	---	---	---	---	---	---	---	---	---	---
7-----------------Glendora	VIw	---	---	---	---	---	---	---	---	---	---	---
8A----------------Morocco	IVs	---	80	---	45	---	36	---	28	---	2.6	---
9B----------------Plainfield	IVs	IIIe	43	150	42	---	---	---	16	52	2.3	4.7
9C----------------Plainfield	VIs	---	---	---	---	---	---	---	---	---	2.0	---
10----------------Aquents and Histosols	VIIIw	---	---	---	---	---	---	---	---	---	---	---
11----------------Edwards	IVw	---	90	---	---	---	---	---	34	---	---	---
12B---------------Spinks-Oshtemo	IIIs	---	84	169	69	---	37	---	28	53	2.8	7.4
12C---------------Spinks-Oshtemo	IIIe	---	77	159	63	---	34	---	25	51	2.4	7.0
17A---------------Brems	IVs	---	70	---	45	---	32	---	24	---	2.3	---
18B---------------Ormas	IIIs	---	60	---	---	---	30	---	21	---	2.0	---
18C---------------Ormas	IIIs	---	55	---	---	---	28	---	19	---	1.8	---
19A---------------Ottokee	IIIs	---	98	---	---	---	---	---	36	---	3.5	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability N	Land capability I	Corn N	Corn I	Oats N	Oats I	Winter wheat N	Winter wheat I	Soybeans N	Soybeans I	Grass-legume hay N	Grass-legume hay I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
20B: Spinks	IIIs	IIIs	75	165	60	---	30	---	27	50	3.0	7.0
20C: Spinks	IIIe	IIIe	68	155	55	---	30	---	23	50	2.4	7.0
22A: Kalamazoo	IIs	IIs	85	175	75	---	40	---	30	55	3.8	4.0
22B: Kalamazoo	IIe	IIe	80	175	75	---	40	---	30	55	3.6	4.0
22C: Kalamazoo	IIIe	IIe	70	170	70	---	38	---	27	50	3.2	4.0
24A: Bronson	IIs	IIs	75	170	60	---	35	---	28	55	3.0	8.0
26: Gilford	Vw	---	---	---	---	---	---	---	---	---	---	---
27: Adrian	IVw	---	75	---	---	---	---	---	23	---	---	---
28: Houghton	IIIw	---	115	---	---	---	---	---	34	---	---	---
32: Colwood	IIw	---	130	---	110	---	65	---	45	---	5.5	---
33B: Tuscola	IIe	---	100	---	80	---	47	---	32	---	3.2	---
36C: Oakville	VIs	---	---	---	35	---	---	---	---	---	1.8	---
36D, 36E: Oakville	VIIs	---	---	---	---	---	---	---	---	---	---	---
37A: Thetford	IIIw	---	80	140	60	---	35	---	30	---	3.0	6.5
38: Napoleon	VIw	---	---	---	---	---	---	---	---	---	---	---
39A: Matherton	IIw	---	105	---	80	---	45	---	36	---	---	---
43: Sloan	Vw	---	---	---	---	---	---	---	---	---	---	---
45B: Covert	IVs	---	---	---	60	---	40	---	---	---	3.0	---
47A: Selfridge	IIIw	---	90	---	70	---	42	---	33	---	3.2	---
48A: Pipestone-Kingsville	IVw	---	65	---	63	---	30	---	---	---	3.0	---
49B: Grattan	VIs	---	---	---	---	---	---	---	---	---	---	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Oats		Winter wheat		Soybeans		Grass-legume hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
50B---------------- Metea	IIIe	---	85	---	---	---	42	---	30	---	2.8	---
50C---------------- Metea	IIIe	---	75	---	---	---	38	---	26	---	2.5	---
51----------------- Kingsville	IVw	---	75	---	70	---	30	---	25	---	3.0	---
52B---------------- Riddles	IIe	---	115	---	---	---	46	---	40	---	3.8	---
52C---------------- Riddles	IIIe	---	105	---	---	---	42	---	37	---	3.4	---
52D---------------- Riddles	IVe	---	90	---	---	---	36	---	32	---	3.0	---
52E---------------- Riddles	VIe	---	---	---	---	---	32	---	---	---	2.5	---
53B---------------- Capac	IIe	---	110	155	95	---	62	---	36	---	4.5	6.8
54----------------- Palms	IIIw	---	105	---	65	---	---	---	42	---	---	---
56----------------- Pewamo	IIw	---	125	---	100	---	60	---	42	---	5.0	---
60----------------- Belleville	IIIw	---	105	---	85	---	50	---	35	---	4.2	---
61B. Udipsamments and Udorthents												
62*. Pits												
64B. Urban land-Coloma												
65B. Urban land-Brems												
66----------------- Algansee-Cohoctah	Vw	---	---	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--YIELDS PER ACRE OF SPECIALTY CROPS

[Only the major soils that are used for specialty crops are listed. Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Apples		Cherries		Asparagus		Wine grapes		Strawberries		Blueberries	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Crates	Crates	Tons	Tons	Crates	Crates	Lbs	Lbs
3B Coloma	---	---	4	5	24	---	4	---	---	500	---	---
3C Coloma	---	---	4	5	---	---	4	---	---	---	---	---
4B Blount	450	---	---	---	---	---	---	---	---	---	---	---
6B Oshtemo	550	---	4	5	38	---	6	---	---	550	---	---
6C Oshtemo	550	---	4	5	---	---	6	---	---	---	---	---
6D Oshtemo-Coloma	550	---	4	5	---	---	6	---	---	---	---	---
8A Morocco	---	---	---	---	---	---	---	---	---	550	---	---
9B Plainfield	---	---	---	---	29	---	3	---	---	550	4,000	7,000
12B Spinks-Oshtemo	550	---	4	5	43	---	6	---	---	---	---	---
12C Spinks-Oshtemo	550	---	4	5	---	---	6	---	---	---	---	---
17A Brems	---	---	---	---	---	---	---	---	---	550	4,000	7,000
18B Ormas	550	---	4	5	43	---	6	---	---	550	---	---
18C Ormas	550	---	4	5	---	---	6	---	---	---	---	---
19A Ottokee	---	---	---	---	---	---	---	---	---	550	4,000	7,000
20B Spinks	550	---	4	5	43	---	6	---	---	550	---	---
20C Spinks	550	---	4	5	---	---	6	---	---	---	---	---
22A Kalamazoo	550	---	4	5	48	---	7	---	---	---	---	---
22B Kalamazoo	550	---	4	5	48	---	7	---	---	---	---	---
22C Kalamazoo	550	---	4	5	---	---	7	---	---	---	---	---
24A Bronson	550	---	4	5	---	---	6	---	---	550	---	---

TABLE 7.--YIELDS PER ACRE OF SPECIALTY CROPS--Continued

Soil name and map symbol	Apples		Cherries		Asparagus		Wine grapes		Strawberries		Blueberries	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Tons	Tons	Crates	Crates	Tons	Tons	Crates	Crates	Lbs	Lbs
27----- Adrian	---	---	---	---	---	---	---	---	---	---	8,000	---
28----- Houghton	---	---	---	---	---	---	---	---	---	---	8,000	---
33B----- Tuscola	400	---	---	---	---	---	---	---	---	---	---	---
36C----- Oakville	---	---	4	5	26	---	4	---	---	500	---	---
36D, 36E----- Oakville	---	---	4	5	---	---	4	---	---	---	---	---
37A----- Thetford	---	---	---	---	---	---	---	---	---	---	5,000	---
45B----- Covert	---	---	---	---	---	---	---	---	---	---	---	8,000
47A----- Selfridge	---	---	---	---	---	---	---	---	---	---	4,000	---
48A----- Pipestone-Kingsville	---	---	---	---	---	---	---	---	---	---	8,000	---
49B----- Grattan	---	---	---	---	26	---	---	---	---	---	---	---
50B----- Metea	550	---	4	5	---	---	5	---	---	550	---	---
50C----- Metea	550	---	4	5	---	---	5	---	---	---	---	---
51----- Kingsville	---	---	---	---	---	---	---	---	---	---	8,000	---
52B----- Riddles	550	---	4	5	---	---	7	---	---	---	---	---
52C----- Riddles	550	---	4	5	---	---	7	---	---	---	---	---
52D----- Riddles	550	---	4	5	---	---	7	---	---	---	---	---
52E----- Riddles	550	---	4	5	---	---	7	---	---	---	---	---
53B----- Capac	550	---	---	---	---	---	---	---	---	---	---	---

TABLE 8.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	---	---	---	---	---
II	80,740	48,502	21,056	11,182	---
III	143,063	32,179	53,550	57,334	---
IV	100,818	1,254	40,451	59,113	---
V	28,443	---	28,443	---	---
VI	19,789	7,484	7,402	4,903	---
VII	7,380	---	---	7,380	---
VIII	4,345	---	4,345	---	---

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume	Trees to plant
								cf/ac/yr	
3B, 3C---------- Coloma	3S	Slight	Slight	Severe	Slight	Black oak----------- Jack pine----------- White oak----------- Eastern white pine--	65 --- --- ---	48 --- --- ---	Red pine, eastern white pine, jack pine.
4B-------------- Blount	3C	Slight	Moderate	Severe	Severe	Northern red oak---- White oak----------- White ash----------- Sugar maple---------	57 57 57 54	40 40 43 34	Eastern white pine, northern white-cedar, white spruce, Norway spruce, yellow-poplar.
6B, 6C---------- Oshtemo	3A	Slight	Slight	Slight	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	48 --- 41 38	Eastern white pine, red pine, white spruce, Norway spruce, imperial Carolina poplar.
6D*:									
Oshtemo---------	3S	Slight	Slight	Moderate	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	48 --- 41 38	Eastern white pine, red pine, white spruce, Norway spruce, imperial Carolina poplar.
Coloma----------	3R	Moderate	Moderate	Severe	Slight	Black oak----------- Jack pine----------- White oak----------- Eastern white pine--	65 --- --- ---	48 --- --- ---	Red pine, eastern white pine, jack pine.
6E*:									
Oshtemo---------	3R	Moderate	Moderate	Moderate	Slight	Northern red oak---- White oak----------- American basswood--- Sugar maple---------	66 --- 66 61	48 --- 41 38	Eastern white pine, red pine, white spruce, Norway spruce, imperial Carolina poplar.
Coloma----------	3R	Moderate	Moderate	Severe	Slight	Black oak----------- Jack pine----------- White oak----------- Eastern white pine--	65 --- --- ---	48 --- --- ---	Red pine, eastern white pine, jack pine.

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume	Trees to plant
								cf/ac/yr	
7---------------Glendora	3W	Slight	Severe	Moderate	Severe	Silver maple--------	90	42	Eastern white pine, white spruce, northern white-cedar, Norway spruce.
						Red maple-----------	65	40	
						Swamp white oak-----	---	---	
						Quaking aspen-------	---	---	
						Black ash-----------	---	---	
						Eastern cottonwood--	---	---	
						White ash-----------	65	63	
8A--------------Morocco	4W	Slight	Moderate	Slight	Slight	Northern red oak----	70	52	Eastern white pine, European larch.
						Eastern white pine--	65	136	
9B, 9C----------Plainfield	8S	Slight	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine, eastern white pine, jack pine.
						Red pine------------	55	88	
						Jack pine-----------	49	71	
						Northern pin oak----	48	32	
						Black oak-----------	---	---	
						White oak-----------	---	---	
11--------------Edwards	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	
						White ash-----------	---	---	
						Green ash-----------	---	---	
						Tamarack------------	---	---	
						Swamp white oak-----	---	---	
						Silver maple--------	---	---	
12B*, 12C*:									
Spinks----------	3S	Slight	Slight	Moderate	Slight	Northern red oak----	66	48	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
Oshtemo---------	3A	Slight	Slight	Slight	Slight	Northern red oak----	66	48	Eastern white pine, red pine, white spruce, Norway spruce, imperial Carolina poplar.
						White oak-----------	---	---	
						American basswood---	66	41	
						Sugar maple---------	61	38	
17A-------------Brems	3S	Slight	Slight	Severe	Slight	Northern red oak----	66	48	Eastern white pine, red pine, jack pine, black walnut.
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Black cherry--------	---	---	
						Black walnut--------	---	---	
						American beech------	---	---	
						American basswood---	67	41	
						Red maple-----------	63	39	
18B, 18C--------Ormas	3S	Slight	Slight	Moderate	Slight	Black oak-----------	65	48	Black walnut, Norway spruce, red pine, eastern white pine, yellow-poplar, white oak.
						White oak-----------	66	48	
						Bigtooth aspen------	75	87	
						Black cherry--------	---	---	
						Yellow-poplar-------	---	---	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume	
								cf/ac/yr	
19A Ottokee	3S	Slight	Slight	Moderate	Slight	Northern red oak White oak Quaking aspen White ash Red maple Bur oak	65 --- --- --- --- ---	48 --- --- --- --- ---	Eastern white pine, white spruce, red pine, imperial Carolina poplar.
20B, 20C Spinks	3S	Slight	Slight	Moderate	Slight	Northern red oak White oak Black oak Black cherry	66 --- --- ---	48 --- --- ---	Red pine, eastern white pine, imperial Carolina poplar.
22A, 22B, 22C Kalamazoo	3A	Slight	Slight	Slight	Slight	Northern red oak White ash Black walnut Yellow-poplar White oak Black cherry American basswood Sugar maple	65 65 65 65 --- --- 65 61	48 63 --- 45 --- --- 41 38	Black walnut, yellow-poplar, eastern white pine, white spruce, Norway spruce, red pine, imperial Carolina poplar.
24A Bronson	3A	Slight	Slight	Slight	Slight	Northern red oak White oak Sugar maple American beech American basswood Shagbark hickory Black walnut	66 66 61 --- --- --- ---	48 48 38 --- --- --- ---	Eastern white pine, red pine, imperial Carolina poplar, black walnut.
26 Gilford	2W	Slight	Severe	Severe	Moderate	Silver maple American basswood Pin oak Red maple White ash Swamp white oak Bur oak	70 --- --- --- --- --- ---	25 --- --- --- --- --- ---	Eastern white pine, Norway spruce, white spruce, European larch.
27 Adrian	2W	Slight	Severe	Severe	Severe	Silver maple Red maple White ash Quaking aspen Tamarack Green ash	78 53 69 60 45 69	32 34 73 64 35 73	
28 Houghton	2W	Slight	Severe	Severe	Severe	Silver maple Red maple White ash Quaking aspen Tamarack Green ash Northern white-cedar	82 56 56 60 45 --- 37	36 36 40 64 35 --- 55	
32 Colwood	2W	Slight	Severe	Severe	Severe	Silver maple Red maple White ash Green ash Swamp white oak	82 56 56 --- ---	36 36 40 --- ---	Eastern white pine, white spruce.

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume	Trees to plant
								cf/ac/yr	
33B Tuscola	4A	Slight	Slight	Slight	Slight	Northern red oak	70	52	Black walnut, yellow-poplar, eastern white pine, Norway spruce, red pine.
						Yellow-poplar	---	---	
						White ash	---	---	
						American basswood	---	---	
						White oak	---	---	
						Sugar maple	---	---	
36C Oakville	3S	Slight	Moderate	Severe	Slight	Northern red oak	67	49	Red pine, eastern white pine.
						Red pine	---	---	
						White oak	---	---	
						Bigtooth aspen	74	86	
						Black oak	---	---	
						Eastern white pine	---	---	
36D Oakville	3R	Moderate	Severe	Severe	Slight	Northern red oak	67	49	Red pine, eastern white pine.
						Red pine	---	---	
						White oak	---	---	
						Bigtooth aspen	74	86	
						Black oak	---	---	
						Eastern white pine	---	---	
36E Oakville	3R	Severe	Severe	Severe	Slight	Northern red oak	67	49	Red pine, eastern white pine.
						Red pine	---	---	
						White oak	---	---	
						Bigtooth aspen	74	86	
						Black oak	---	---	
						Eastern white pine	---	---	
37A Thetford	3W	Slight	Moderate	Slight	Moderate	Red maple	65	40	White spruce, Norway spruce, eastern white pine, imperial Carolina poplar.
						White ash	---	---	
						Quaking aspen	---	---	
						Eastern cottonwood	---	---	
						Northern red oak	---	---	
						Swamp white oak	---	---	
						Bitternut hickory	---	---	
38 Napoleon	2W	Slight	Severe	Severe	Severe	Red maple	56	36	
						Silver maple	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Tamarack	---	---	
						Black ash	---	---	
39A Matherton	3W	Slight	Moderate	Slight	Moderate	Northern red oak	62	45	White spruce, Norway spruce, eastern white pine.
						Swamp white oak	---	---	
						White oak	---	---	
						White ash	---	---	
						American basswood	---	---	
						Red maple	---	---	
43 Sloan	3W	Slight	Severe	Severe	Severe	Red maple	66	41	White spruce, northern white-cedar.
						Swamp white oak	---	---	
						White ash	66	65	
						Green ash	66	65	
						Eastern cottonwood	89	---	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume	Trees to plant
								cf/ac/yr	
45B------------- Covert	3S	Slight	Moderate	Severe	Slight	Northern red oak----	67	49	Red pine, black walnut, eastern white pine.
						Red maple-----------	66	41	
						Black cherry--------	---	---	
						Eastern cottonwood--	---	---	
						American basswood---	---	---	
						White oak-----------	---	---	
						Quaking aspen-------	---	---	
						American beech------	---	---	
						Eastern white pine--	---	---	
47A------------- Selfridge	6W	Slight	Moderate	Moderate	Moderate	Quaking aspen-------	70	81	Eastern white pine, Norway spruce, imperial Carolina poplar.
						American beech------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American basswood---	---	---	
48A*:									
Pipestone------	3W	Slight	Moderate	Slight	Moderate	Red maple-----------	65	40	White spruce, eastern white pine.
						White ash-----------	---	---	
						Eastern cottonwood--	---	---	
						Bitternut hickory---	---	---	
						Hackberry-----------	---	---	
						American basswood---	56	36	
						Eastern white pine--	64	133	
Kingsville-----	3W	Slight	Severe	Severe	Severe	Red maple-----------	65	40	Eastern white pine, green ash, white spruce.
						Green ash-----------	---	---	
						Black cherry--------	---	---	
						Eastern cottonwood--	---	---	
						Swamp white oak-----	---	---	
49B------------- Grattan	9S	Slight	Moderate	Severe	Slight	Eastern white pine--	62	127	Red pine, eastern white pine.
						Quaking aspen-------	---	---	
						White oak-----------	---	---	
						Black oak-----------	---	---	
50B, 50C-------- Metea	3S	Slight	Moderate	Moderate	Slight	Northern red oak----	66	48	Eastern white pine, red pine, white spruce, black walnut, Norway spruce.
						White oak-----------	---	---	
						Sugar maple---------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						Black walnut--------	---	---	
						Shagbark hickory----	---	---	
51-------------- Kingsville	3W	Slight	Severe	Severe	Severe	Red maple-----------	65	40	Eastern white pine, green ash, white spruce.
						Green ash-----------	---	---	
						Black cherry--------	---	---	
						Eastern cottonwood--	---	---	
						Swamp white oak-----	---	---	
52B, 52C-------- Riddles	4A	Slight	Slight	Slight	Slight	Northern red oak----	75	57	Black walnut, red pine, white spruce.
						Red maple-----------	75	47	
						White ash-----------	75	78	
						Green ash-----------	75	78	
						Black walnut--------	---	---	
						Yellow-poplar-------	---	---	

See footnote at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume	Trees to plant
								cf/ac/yr	
52D, 52E: Riddles	4R	Moderate	Moderate	Slight	Slight	Northern red oak	75	57	Black walnut, red pine, white spruce.
						Red maple	75	47	
						White ash	75	78	
						Green ash	75	78	
						Black walnut	---	---	
						Yellow-poplar	---	---	
53B: Capac	3W	Slight	Moderate	Slight	Moderate	Northern red oak	65	48	Eastern white pine, white spruce, Norway spruce.
						American basswood	---	---	
						Northern pin oak	---	---	
						White ash	---	---	
						Red maple	---	---	
						Bitternut hickory	---	---	
						Sugar maple	---	---	
						Black cherry	---	---	
						American beech	---	---	
54: Palms	2W	Slight	Severe	Severe	Severe	Red maple	55	35	
						Silver maple	---	---	
						White ash	---	---	
						Quaking aspen	---	---	
						Northern white-cedar	---	---	
						Tamarack	---	---	
						Black ash	---	---	
56: Pewamo	3W	Slight	Severe	Moderate	Moderate	Red maple	66	41	Imperial Carolina poplar, eastern white pine, white spruce, Norway spruce.
						American basswood	66	41	
						Silver maple	---	---	
						White ash	---	---	
						Black ash	---	---	
						Eastern cottonwood	---	---	
60: Belleville	1W	Slight	Severe	Moderate	Moderate	Silver maple	64	20	
						Red maple	---	---	
						White ash	---	---	
						Pin oak	---	---	
						Swamp white oak	---	---	
66*:									
Algansee	4W	Slight	Moderate	Slight	Slight	Quaking aspen	60	64	White spruce, imperial Carolina poplar, Norway spruce, eastern white pine.
						Silver maple	78	32	
						Swamp white oak	---	---	
						White ash	---	---	
						Red maple	56	36	
						American sycamore	---	---	
						Green ash	---	---	
Cohoctah	2W	Slight	Severe	Severe	Severe	Red maple	56	36	Eastern white pine, white spruce, northern white-cedar.
						Eastern cottonwood	---	---	
						Silver maple	80	34	
						White ash	---	---	
						Swamp white oak	---	---	
						American sycamore	---	---	
						Pin oak	---	---	
						Bitternut hickory	---	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
3B, 3C------------ Coloma	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---
4B---------------- Blount	---	American cranberrybush, Amur privet, white spruce, late lilac, northern white-cedar.	---	White ash, red pine, eastern white pine, Norway spruce, red maple, silver maple.	Green ash.
6B, 6C------------ Oshtemo	---	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, nannyberry viburnum.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
6D*, 6E*:					
Oshtemo----------	---	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, nannyberry viburnum.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
Coloma-----------	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	---	Eastern white pine, red pine, jack pine, Norway spruce.	---
7. Glendora					
8A---------------- Morocco	Manyflower cotoneaster.	Lilac, silky dogwood.	Siberian peashrub, Austrian pine, black spruce.	Eastern white pine, red pine, jack pine, Norway spruce.	Green ash, imperial Carolina poplar.
9B, 9C------------ Plainfield	Manyflower cotoneaster.	Siberian peashrub, lilac, eastern redcedar, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce-----	Eastern white pine, red pine, jack pine.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10*: Aquents.					
Histosols.					
11 Edwards	---	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, Amur maple.	Manchurian crabapple, northern white-cedar.	White spruce, green ash, black willow.	Imperial Carolina poplar.
12B*, 12C*: Spinks	Manyflower cotoneaster.	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	Red pine, white spruce, jack pine.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
Oshtemo	---	Eastern redcedar, lilac, Siberian peashrub, silky dogwood, American cranberrybush, nannyberry viburnum.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
17A Brems	Manyflower cotoneaster.	Eastern redcedar, Amur maple, Siberian peashrub, gray dogwood.	Red pine, lilac	Norway spruce, eastern white pine, jack pine, Siberian crabapple, green ash.	---
18B, 18C Ormas	Manyflower cotoneaster.	Lilac, silky dogwood, eastern redcedar, American cranberrybush, Siberian peashrub.	Red pine, jack pine, white spruce.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
19A Ottokee	---	Common ninebark, silky dogwood, Roselow sargent crabapple, lilac, American cranberrybush, Amur privet, nannyberry viburnum.	White spruce	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
20B, 20C Spinks	Manyflower cotoneaster.	American cranberrybush, silky dogwood, eastern redcedar, lilac, Siberian peashrub.	Red pine, white spruce, jack pine.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
22A, 22B, 22C----- Kalamazoo	---	Lilac, American cranberrybush, Siberian peashrub, silky dogwood, nannyberry viburnum, eastern redcedar.	Red pine, jack pine, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
24A--------------- Bronson	---	Amur privet, silky dogwood, lilac, common ninebark, Siberian crabapple, nannyberry viburnum.	White spruce------	Eastern white pine, red pine, Norway spruce, green ash.	Imperial Carolina poplar.
26---------------- Gilford	Silky dogwood, American cranberrybush.	Amur privet, white spruce, Tatarian honeysuckle, northern white-cedar.	Norway spruce, green ash, Manchurian crabapple.	Eastern white pine	Imperial Carolina poplar.
27---------------- Adrian	---	Silky dogwood, common ninebark, Amur privet, American cranberrybush, late lilac, Japanese tree lilac, nannyberry viburnum.	Northern white-cedar.	Eastern white pine, Siberian crabapple, green ash.	Imperial Carolina poplar.
28---------------- Houghton	---	Silky dogwood, lilac, Amur privet, common ninebark, nannyberry viburnum.	Japanese tree lilac, northern white-cedar.	Black willow, green ash, Siberian crabapple.	Imperial Carolina poplar.
32---------------- Colwood	---	Silky dogwood, American cranberrybush, Amur privet, nannyberry viburnum, lilac.	Manchurian crabapple, northern white-cedar, white spruce.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
33B--------------- Tuscola	---	Common ninebark, Siberian crabapple, Amur privet, American cranberrybush, lilac, gray dogwood, silky dogwood.	White spruce------	Eastern white pine, Norway spruce, red maple, red pine.	---
36C, 36D, 36E----- Oakville	---	Silky dogwood, lilac, Siberian dogwood, Amur privet.	White spruce, Manchurian crabapple.	Eastern white pine, red pine, eastern white pine, Norway spruce, jack pine.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
37A. Thetford	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	White spruce, northern white-cedar.	Norway spruce, eastern white pine, red maple, green ash.	Imperial Carolina poplar.
38. Napoleon					
39A. Matherton	Vanhoutte spirea	Silky dogwood, nannyberry viburnum, Amur privet, Amur maple, American cranberrybush.	Northern white-cedar, white spruce, Manchurian crabapple.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
43. Sloan	Vanhoutte spirea	Green ash, silky dogwood, Amur privet, white spruce, Tatarian honeysuckle, American cranberrybush.	Northern white-cedar, Manchurian crabapple.	---	Imperial Carolina poplar.
45B. Covert	---	Lilac, American cranberrybush, Amur privet, Amur maple, silky dogwood.	White spruce, northern white-cedar.	Red maple, eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
47A. Selfridge	---	Silky dogwood, lilac, Amur maple, American cranberrybush, Amur privet.	Northern white-cedar, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	Imperial Carolina poplar.
48A*:					
Pipestone	---	Lilac, Amur maple, Amur privet, silky dogwood, American cranberrybush.	Northern white-cedar, white spruce.	Red maple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Kingsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, Washington hawthorn.	Eastern white pine	Imperial Carolina poplar.
49B. Grattan	Vanhoutte spirea	Lilac, Amur privet, autumn-olive, Tatarian honeysuckle, hedge cotoneaster, Siberian peashrub.	Siberian crabapple, eastern redcedar, Austrian pine.	Red pine, eastern white pine.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
50B, 50C Metea	Manyflower cotoneaster.	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
51 Kingsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, Washington hawthorn.	Eastern white pine	Imperial Carolina poplar.
52B, 52C, 52D, 52E Riddles	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
53B Capac	---	Silky dogwood, American cranberrybush, Amur privet, Amur maple, lilac.	White spruce, northern white-cedar.	Eastern white pine, red maple, Norway spruce, green ash.	Imperial Carolina poplar.
54 Palms	Vanhoutte spirea	Silky dogwood, common ninebark, nannyberry viburnum, American cranberrybush.	Northern white-cedar, Manchurian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
56 Pewamo	---	American cranberrybush, silky dogwood, Amur privet, lilac, common ninebark.	Northern white-cedar, Siberian crabapple, white spruce.	Green ash, Norway spruce, eastern white pine.	Imperial Carolina poplar.
60 Belleville	---	Silky dogwood, Amur privet, nannyberry viburnum, lilac, American cranberrybush.	White spruce, northern white-cedar, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
61B*: Udipsamments.					
Udorthents.					
62*. Pits					

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
64B*:					
Urban land.					
Coloma	Manyflower cotoneaster.	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	White spruce	Norway spruce, eastern white pine, red pine, jack pine.	---
65B*:					
Urban land.					
Brems	Manyflower cotoneaster.	Eastern redcedar, Amur maple, Siberian peashrub, gray dogwood.	Red pine, lilac	Norway spruce, eastern white pine, jack pine, Siberian crab-apple, green ash.	---
66*:					
Algansee	---	Amur privet, Amur maple, lilac, American cranberrybush.	White spruce, northern white-cedar, white spruce.	Green ash, eastern white pine, Norway spruce, red maple.	Imperial Carolina poplar.
Cohoctah	---	Amur privet, Amur privet, American cranberrybush, lilac, nannyberry viburnum, silky dogwood.	Northern white-cedar, Manchurian crabapple, white spruce.	Green ash, eastern white pine.	Imperial Carolina poplar.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
3B Coloma	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones, droughty.
3C Coloma	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, droughty, slope.
4B Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
6B Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
6C Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
6D*, 6E*:					
Oshtemo	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
Coloma	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
7 Glendora	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
8A Morocco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
9B Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
9C Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
10*:					
Aquents.					
Histosols.					
11 Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
12B*:					
Spinks	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
12B*:					
Oshtemo	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
12C*:					
Spinks	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Oshtemo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
17A Brems	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
18B Ormas	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
18C Ormas	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
19A Ottokee	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Moderate: droughty.
20B Spinks	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
20C Spinks	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
22A Kalamazoo	Slight	Slight	Moderate: small stones.	Slight	Slight.
22B Kalamazoo	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
22C Kalamazoo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
24A Bronson	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
26 Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
27 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
28 Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
32 Colwood	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
33B Tuscola	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
36C Oakville	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty.
36D Oakville	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
36E Oakville	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
37A Thetford	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
38 Napoleon	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.	Severe: too acid, ponding, excess humus.
39A Matherton	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
43 Sloan	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
45B Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
47A Selfridge	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
48A*: Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.	Severe: wetness.
Kingsville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
49B Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
50B Metea	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Moderate: droughty.
50C Metea	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: droughty, slope.
51 Kingsville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
52B: Riddles	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
52C: Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
52D, 52E: Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
53B: Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
54: Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
56: Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
60: Belleville	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
61B*: Udipsamments.					
Udorthents.					
62*. Pits					
64B*: Urban land.					
Coloma	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones, droughty.
65B*: Urban land.					
Brems	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
66*: Algansee	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: flooding, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
3B Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
3C Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
4B Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
6B Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
6C Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
6D*:										
Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
6E*:										
Oshtemo	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
7 Glendora	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
8A Morocco	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
9B Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
9C Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
10*:										
Aquents.										
Histosols.										
11 Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
12B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Oshtemo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
12C*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Oshtemo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
17A Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.
18B Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
18C Ormas	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
19A Ottokee	Poor	Fair	Good	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
20B Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
20C Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
22A, 22B Kalamazoo	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
22C Kalamazoo	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
24A Bronson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
26 Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
27 Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
28 Houghton	Fair	Poor	Poor	Fair	Fair	Good	Good	Poor	Poor	Good.
32 Colwood	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
33B Tuscola	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
36C, 36D Oakville	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
36E Oakville	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
37A Thetford	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
38 Napoleon	Very poor.	Very poor.	Poor	Fair	Poor	Good	Good	Very poor.	Poor	Good.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
39A-----Matherton	Good	Good	Good	Good	Fair	Fair	Fair	Good	Good	Fair.
43-----Sloan	Fair	Fair	Good	Poor	Poor	Good	Good	Fair	Poor	Good.
45B-----Covert	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor.
47A-----Selfridge	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
48A*:										
Pipestone-----	Poor	Poor	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
Kingsville-----	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
49B-----Grattan	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
50B-----Metea	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
50C-----Metea	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
51-----Kingsville	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
52B-----Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
52C-----Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
52D-----Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
52E-----Riddles	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
53B-----Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
54-----Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
56-----Pewamo	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
60-----Belleville	Poor	Fair	Fair	Poor	Poor	Fair	Good	Fair	Poor	Fair.
61B*:										
Udipsamments.										
Udorthents.										

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
62*. Pits										
64B*: Urban land.										
Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
65B*: Urban land.										
Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.
66*: Algansee	Very poor.	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair.
Cohoctah	Poor	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
3B---------------- Coloma	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: large stones, droughty.
3C---------------- Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, droughty, slope.
4B---------------- Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
6B---------------- Oshtemo	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: small stones.
6C---------------- Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
6D*, 6E*:						
Oshtemo----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Coloma-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
7----------------- Glendora	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
8A---------------- Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
9B---------------- Plainfield	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
9C---------------- Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
10*:						
Aquents.						
Histosols.						
11---------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
12B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Oshtemo	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: small stones.
12C*:						
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Oshtemo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
17A Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
18B Ormas	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
18C Ormas	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
19A Ottokee	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
20B Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
20C Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
22A Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
22B Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
22C Kalamazoo	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
24A Bronson	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
26 Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27: Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
28: Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
32: Colwood	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
33B: Tuscola	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Slight.
36C: Oakville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
36D, 36E: Oakville	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
37A: Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
38: Napoleon	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: too acid, ponding, excess humus.
39A: Matherton	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
43: Sloan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
45B: Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
47A: Selfridge	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
48A*:						
Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
49B-------------- Grattan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
50B-------------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
50C-------------- Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
51--------------- Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
52B-------------- Riddles	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
52C-------------- Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
52D, 52E--------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
53B-------------- Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
54--------------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
56--------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
60--------------- Belleville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
61B*: Udipsamments.						
Udorthents.						
62*. Pits						
64B*: Urban land.						
Coloma-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: large stones, droughty.
65B*: Urban land.						

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
65B*:						
Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
66*:						
Algansee	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
Cohoctah	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action, wetness.	Severe: flooding, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "poor," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
3B----------------- Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
3C----------------- Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
4B----------------- Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
6B----------------- Oshtemo	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
6C----------------- Oshtemo	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
6D*, 6E*:					
Oshtemo------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
Coloma-------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
7------------------ Glendora	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
8A----------------- Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
9B----------------- Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
9C----------------- Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
10*:					
Aquents.					
Histosols.					

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11----------------- Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding, excess humus.
12B*:					
Spinks-------------	Slight-----------	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Oshtemo------------	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
12C*:					
Spinks-------------	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Oshtemo------------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
17A---------------- Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
18B---------------- Ormas	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
18C---------------- Ormas	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
19A---------------- Ottokee	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy.
20B---------------- Spinks	Slight-----------	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
20C---------------- Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
22A, 22B----------- Kalamazoo	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
22C---------------- Kalamazoo	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
24A---------------- Bronson	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
26------------------- Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
27------------------- Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
28------------------- Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
32------------------- Colwood	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, thin layer.
33B------------------ Tuscola	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy.
36C------------------ Oakville	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
36D, 36E------------- Oakville	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
37A------------------ Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
38------------------- Napoleon	Severe: ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
39A------------------ Matherton	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
43------------------- Sloan	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
45B------------------ Covert	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
47A------------------ Selfridge	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
48A*:					
Pipestone	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Kingsville	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
49B Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
50B Metea	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
50C Metea	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
51 Kingsville	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
52B Riddles	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
52C Riddles	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
52D, 52E Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
53B Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54 Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
56 Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
60 Belleville	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
61B*:					
Udipsamments.					
Udorthents.					

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
62*. Pits					
64B*: Urban land.					
Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
65B*: Urban land.					
Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
66*: Algansee	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Cohoctah	Severe: wetness, flooding.	Severe: flooding, seepage, wetness.	Severe: seepage, flooding, wetness.	Severe: seepage, flooding, wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
3B Coloma	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
3C Coloma	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones, slope.
4B Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
6B, 6C Oshtemo	Good	Probable	Probable	Poor: small stones.
6D*, 6E*:				
Oshtemo	Fair: slope.	Probable	Probable	Poor: small stones, slope.
Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
7 Glendora	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
8A Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
9B, 9C Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
10*:				
Aquents.				
Histosols.				
11 Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
12B*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
Oshtemo	Good	Probable	Probable	Poor: small stones.
12C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
Oshtemo	Good	Probable	Probable	Poor: small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
17A-------------------- Brems	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
18B-------------------- Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
18C-------------------- Ormas	Good	Probable	Probable	Fair: too sandy, small stones, slope.
19A-------------------- Ottokee	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
20B-------------------- Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
20C-------------------- Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
22A, 22B, 22C---------- Kalamazoo	Good	Probable	Probable	Poor: small stones, area reclaim.
24A-------------------- Bronson	Fair: wetness.	Probable	Probable	Poor: small stones.
26--------------------- Gilford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
27--------------------- Adrian	Poor: wetness, low strength.	Probable	Improbable: too sandy.	Poor: wetness, excess humus.
28--------------------- Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
32--------------------- Colwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
33B-------------------- Tuscola	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
36C-------------------- Oakville	Good	Probable	Improbable: too sandy.	Poor: too sandy.
36D-------------------- Oakville	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
36E-------------------- Oakville	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
37A-------------------- Thetford	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy, small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
38 Napoleon	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness, too acid.
39A Matherton	Fair: wetness.	Probable	Probable	Poor: area reclaim.
43 Sloan	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
45B Covert	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
47A Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, area reclaim, small stones.
48A*:				
Pipestone	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Kingsville	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, too sandy.
49B Grattan	Good	Probable	Improbable: too sandy.	Poor: too sandy.
50B Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy, area reclaim.
50C Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy, area reclaim.
51 Kingsville	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness, too sandy.
52B Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
52C Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
52D, 52E Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
53B Capac	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
54 Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
56 Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
60 Belleville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
61B*:				
Udipsamments.				
Udorthents.				
62*. Pits				
64B*:				
Urban land.				
Coloma	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones.
65B*:				
Urban land.				
Brems	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
66*:				
Algansee	Fair: wetness.	Probable	Improbable: too sandy.	Good.
Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
3B: Coloma	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
3C: Coloma	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
4B: Blount	Slight	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
6B: Oshtemo	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
6C: Oshtemo	Severe: seepage, slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, too sandy, soil blowing.	Slope.
6D*, 6E*:						
Oshtemo	Severe: seepage, slope.	Severe: no water.	Deep to water	Fast intake, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope.
Coloma	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
7: Glendora	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
8A: Morocco	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Droughty, fast intake, wetness.	Wetness, too sandy, soil blowing.	Wetness, droughty.
9B: Plainfield	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
9C: Plainfield	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Droughty, slope.
10*:						
Aquents.						
Histosols.						
11: Edwards	Severe: seepage.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
12B*:						
Spinks	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Oshtemo	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
12C*:						
Spinks	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Oshtemo	Severe: seepage, slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, too sandy, soil blowing.	Slope.
17A Brems	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
18B Ormas	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
18C Ormas	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, soil blowing.	Slope, droughty.
19A Ottokee	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Fast intake, wetness, droughty.	Too sandy, soil blowing, wetness.	Droughty.
20B Spinks	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
20C Spinks	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
22A, 22B Kalamazoo	Severe: seepage.	Severe: no water.	Deep to water	Favorable	Favorable	Favorable.
22C Kalamazoo	Severe: seepage, slope.	Severe: no water.	Deep to water	Favorable	Slope	Slope.
24A Bronson	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Favorable.
26 Gilford	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
27 Adrian	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing.	Ponding, soil blowing, too sandy.	Wetness.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
28---------------- Houghton	Severe: seepage.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
32---------------- Colwood	Moderate: seepage.	Severe: cutbanks cave.	Ponding, frost action.	Ponding--------	Erodes easily, ponding.	Wetness, erodes easily.
33B--------------- Tuscola	Moderate: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness--------	Wetness, too sandy.	Favorable.
36C--------------- Oakville	Severe: seepage.	Severe: no water.	Deep to water	Fast intake, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
36D, 36E---------- Oakville	Severe: seepage, slope.	Severe: no water.	Deep to water	Fast intake, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
37A--------------- Thetford	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
38---------------- Napoleon	Severe: seepage.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding, too acid.	Ponding--------	Wetness.
39A--------------- Matherton	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness--------	Wetness, too sandy.	Wetness.
43---------------- Sloan	Moderate: seepage.	Severe: slow refill.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
45B--------------- Covert	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
47A--------------- Selfridge	Severe: seepage.	Severe: no water.	Frost action---	Wetness, fast intake, soil blowing.	Wetness, soil blowing, erodes easily.	Wetness, erodes easily.
48A*:						
Pipestone---------	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Kingsville--------	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
49B--------------- Grattan	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
50B--------------- Metea	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
50C--------------- Metea	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
51----------------- Kingsville	Severe: seepage.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
52B---------------- Riddles	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
52C, 52D, 52E------ Riddles	Severe: slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
53B---------------- Capac	Moderate: slope.	Severe: slow refill.	Slope, frost action.	Wetness, slope.	Wetness---------	Wetness.
54----------------- Palms	Severe: seepage.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
56----------------- Pewamo	Slight---------	Severe: slow refill.	Ponding, frost action.	Ponding--------	Ponding---------	Wetness.
60----------------- Belleville	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding, droughty, fast intake.	Ponding, soil blowing.	Wetness, droughty.
61B*: Udipsamments.						
Udorthents.						
62*. Pits						
64B*: Urban land.						
Coloma-----------	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
65B*: Urban land.						
Brems------------	Severe: seepage.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty.
66*: Algansee---------	Severe: seepage.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, flooding.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Cohoctah---------	Severe: seepage.	Slight---------	Flooding, frost action.	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
3B, 3C----------- Coloma	0-10	Loamy sand-------	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	10-34	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	34-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
4B--------------- Blount	0-9	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	9-28	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	28-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
6B, 6C----------- Oshtemo	0-19	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	19-42	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	42-60	Stratified loamy sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
6D*, 6E*:											
Oshtemo---------	0-19	Loamy sand-------	SM	A-2, A-1, A-4	0	95-100	60-95	40-70	15-40	---	NP
	19-42	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	42-60	Stratified loamy sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
Coloma----------	0-10	Loamy sand-------	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	10-34	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	34-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
7---------------- Glendora	0-7	Sandy loam-------	SP-SM, SM	A-3, A-2, A-4, A-1	0-5	95-100	90-100	45-95	5-40	<20	NP-4
	7-60	Stratified sand to loamy fine sand.	SP, SM, SP-SM	A-3, A-2-4, A-1-b	0-5	95-100	90-100	45-85	0-35	---	NP
8A--------------- Morocco	0-8	Loamy sand-------	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	8-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
9B, 9C----------- Plainfield	0-9	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	9-20	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-70	1-15	---	NP
	20-60	Sand, fine sand, coarse sand.	SP, SM, SP-SM	A-3, A-1, A-2	0	75-100	75-100	40-90	1-15	---	NP
10*:											
Aquents.											
Histosols.											

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
11---------------- Edwards	0-48	Sapric material	PT	A-8	0	---	---	---	---	---	---
	48-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---
12B*, 12C*:											
Spinks-----------	0-19	Loamy sand-------	SM	A-2-4	0	100	80-100	50-90	15-30	---	NP
	19-30	Loamy sand, sand	SM, SP-SM	A-2-4, A-3	0	100	80-100	50-90	5-25	---	NP
	30-60	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
Oshtemo----------	0-19	Sandy loam-------	SM, SM-SC	A-2, A-4	0	95-100	60-95	60-70	25-40	15-25	2-7
	19-42	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0	95-100	60-95	60-85	25-45	12-30	2-16
	42-60	Stratified loamy sand to gravel.	SP-SM, GP, SP, GP-GM	A-1, A-2, A-3	0-5	40-90	35-85	20-60	0-10	---	NP
17A--------------- Brems	0-10	Sand-------------	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	10-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
18B, 18C---------- Ormas	0-15	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	15-40	Sand, fine sand	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	40-55	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-80	55-80	35-70	20-45	20-40	6-20
	55-60	Gravelly sand, very gravelly sand, coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
19A--------------- Ottokee	0-26	Loamy fine sand	SM	A-2	0	100	90-100	65-80	20-35	---	NP
	26-60	Loamy fine sand, fine sand, loamy sand.	SM	A-2	0	100	90-100	65-80	20-35	---	NP
20B, 20C---------- Spinks	0-19	Loamy sand-------	SM	A-2-4	0	100	80-100	50-90	15-30	---	NP
	19-30	Loamy sand, sand	SM, SP-SM	A-2-4, A-3	0	100	80-100	50-90	5-25	---	NP
	30-60	Stratified fine sand to loamy fine sand.	SM, SP-SM	A-2-4	0	100	80-100	60-90	10-30	---	NP
22A, 22B, 22C---- Kalamazoo	0-10	Loam-------------	ML, CL-ML, CL	A-4	0-5	95-100	80-100	80-90	55-70	<25	NP-10
	10-39	Clay loam, sandy clay loam, gravelly sandy loam.	SC, CL	A-4, A-6	0-5	95-100	70-95	65-95	35-80	20-38	9-20
	39-60	Sand, gravelly sand.	SP, SP-SM	A-1, A-3, A-2	0-5	60-80	25-75	10-55	0-10	---	NP
24A--------------- Bronson	0-9	Sandy loam-------	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	65-75	20-40	<25	NP-5
	9-43	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	60-95	60-85	25-45	<30	NP-15
	43-60	Loamy sand, gravelly loamy sand.	SM, SP-SM	A-2	0-5	85-95	60-95	55-70	10-15	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26-------------- Gilford	0-14	Sandy loam-------	SC, SM-SC	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	4-10
	14-35	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	20-35	15-30	NP-8
	35-60	Loamy sand, sand	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
27-------------- Adrian	0-36	Sapric material	PT	A-8	---	---	---	---	---	---	---
	36-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
28-------------- Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
32-------------- Colwood	0-14	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	15-35	2-12
	14-35	Loam, silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	100	100	80-100	50-90	20-40	6-20
	35-60	Stratified silt loam to fine sand.	SM, ML	A-2, A-4	0	100	95-100	70-100	30-80	<35	NP-10
33B------------- Tuscola	0-14	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	20-30	3-10
	14-30	Silty clay loam, loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-90	20-40	6-20
	30-60	Stratified fine sand to silt loam.	SM, ML	A-4	0	100	95-100	75-90	40-90	<25	NP-4
36C, 36D, 36E---- Oakville	0-9	Fine sand--------	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	9-60	Fine sand, sand, loamy fine sand.	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
37A------------- Thetford	0-11	Loamy sand-------	SM	A-2, A-4	0	95-100	90-100	70-85	20-45	<20	NP-4
	11-45	Loamy sand, sandy loam.	SM	A-2, A-4	0	95-100	90-100	60-80	20-40	<20	NP-4
	45-60	Very fine sand, fine sand, sand.	SM, SP, SP-SM	A-2, A-4, A-3	0	95-100	70-100	50-85	0-45	<20	NP-4
38-------------- Napoleon	0-16	Hemic material---	PT	A-8	0	---	---	---	---	---	---
	16-60	Hemic material---	PT	A-8	0	---	---	---	---	---	---
39A------------- Matherton	0-13	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-100	80-100	80-95	50-90	20-30	NP-8
	13-25	Sandy clay loam, gravelly clay loam, loam.	SC, CL, CL-ML, SM-SC	A-6, A-4	0-5	90-100	65-95	50-85	35-70	25-40	5-20
	25-60	Gravelly sand, sand.	GP, SP, SP-SM, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-90	30-55	0-10	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
43--------------- Sloan	0-10	Loam-------------	CL, ML, CL-ML	A-6, A-4	0	100	95-100	85-100	70-95	20-40	3-15
	10-50	Silty clay loam, clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	75-95	30-45	8-18
	50-60	Stratified gravelly sandy loam to silty clay loam.	ML, CL	A-4, A-6	0	95-100	70-100	60-95	50-90	25-40	3-15
45B-------------- Covert	0-8	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	8-35	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	35-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
47A-------------- Selfridge	0-33	Loamy sand-------	SM, SM-SC	A-2	0-5	95-100	95-100	70-85	20-35	<20	NP-5
	33-35	Sandy loam-------	SM, SC, SM-SC	A-2, A-4	0-5	95-100	95-100	65-80	25-45	15-30	NP-10
	35-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-90	25-50	10-25
48A*:											
Pipestone-------	0-14	Fine sand--------	SP, SM, SP-SM	A-2-4, A-3	0	95-100	90-100	60-80	0-20	---	NP
	14-26	Sand, loamy sand, fine sand.	SP-SM, SP, SM	A-2-4, A-3	0	95-100	90-100	60-80	0-15	---	NP
	26-60	Sand, fine sand, loamy coarse sand.	SP-SM, SP	A-3, A-2-4	0	95-100	90-100	50-80	0-10	---	NP
Kingsville------	0-8	Loamy sand-------	SM	A-2, A-4	0	100	90-100	50-80	15-45	---	NP
	8-30	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-4	0	100	90-100	50-80	10-45	---	NP
	30-60	Fine sand, sand, loamy fine sand.	SM, SW-SM, SP-SM	A-2, A-3, A-4, A-1	0	95-100	85-100	45-80	5-45	---	NP
49B-------------- Grattan	0-14	Sand-------------	SM, SP-SM	A-2-4, A-3	0	95-100	95-100	60-80	5-15	---	NP
	14-26	Sand-------------	SM, SP-SM, SP	A-2-4, A-3	0	95-100	90-100	60-85	0-15	---	NP
	26-60	Sand, coarse sand	SP, SP-SM	A-1, A-2-4, A-3	0	95-100	90-100	40-85	0-10	---	NP
50B, 50C--------- Metea	0-10	Loamy fine sand	SM	A-2-4	0	100	100	50-80	15-35	---	---
	10-26	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	26-28	Sandy loam, sandy clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-55	18-27	4-9
	28-36	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	36-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
51--------------- Kingsville	0-8	Loamy sand-------	SM	A-2, A-4	0	100	90-100	50-80	15-45	---	NP
	8-30	Fine sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-4	0	100	90-100	50-80	10-45	---	NP
	30-60	Fine sand, sand, loamy fine sand.	SM, SW-SM, SP-SM	A-2, A-3, A-4, A-1	0	95-100	85-100	45-80	5-45	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
52B, 52C, 52D, 52E------------- Riddles	0-8	Sandy loam-------	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	8-17	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	17-45	Clay loam, sandy clay loam.	CL	A-6, A-7	0	90-100	80-95	75-95	65-75	35-50	15-30
	45-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
53B-------------- Capac	0-12	Loam------------	CL, ML, CL-ML	A-4	0-5	95-100	90-100	80-95	60-75	<25	3-10
	12-27	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	50-80	25-40	5-20
	27-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-75	15-35	5-15
54--------------- Palms	0-24	Sapric material	PT	A-8	---	---	---	---	---	---	---
	24-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
56--------------- Pewamo	0-11	Silty clay loam	CL	A-6, A-7	0-5	90-100	80-100	80-100	70-90	35-50	15-25
	11-36	Clay loam, clay, silty clay.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	36-60	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
60--------------- Belleville	0-14	Loamy sand-------	SM	A-2	0	100	95-100	70-85	20-35	<20	NP-4
	14-32	Fine sand, loamy sand, loamy fine sand.	SM	A-2	0-3	95-100	90-100	50-85	15-30	<20	NP-4
	32-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0-3	95-100	90-100	90-100	70-90	25-50	10-25
61B*: Udipsamments.											
Udorthents.											
62*. Pits											
64B*: Urban land.											
Coloma----------	0-10	Loamy sand-------	SM	A-2, A-4	0-8	75-100	75-100	50-90	15-50	---	NP
	10-34	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
	34-60	Stratified sand to sandy loam.	SP, SM, SP-SM	A-2, A-3, A-4	0-8	75-100	75-100	50-100	2-40	---	NP
65B*: Urban land.											
Brems-----------	0-10	Sand-------------	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	10-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
66*: Algansee--------	0-7	Fine sandy loam	SM	A-2-4, A-4	0	100	100	60-80	30-50	---	NP
	7-60	Stratified sand to loam.	SM, SP-SM	A-3, A-2-4	0	100	100	50-70	5-15	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
66*:											
Cohoctah--------	0-10	Sandy loam-------	ML, SM	A-4, A-2	0	100	100	65-95	30-75	<30	NP-6
	10-60	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	80-100	70-90	30-70	<30	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
3B, 3C-----------	0-10	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-6.5	Low-----------	0.17	5	2	<1
Coloma	10-34	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.0	Low-----------	0.15			
	34-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
4B---------------	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low-----------	0.43	3	6	2-3
Blount	9-28	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-6.5	Moderate-----	0.43			
	28-60	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
6B, 6C-----------	0-19	2-10	1.20-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
Oshtemo	19-42	10-18	1.20-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	42-60	0-15	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
6D*, 6E*:											
Oshtemo---------	0-19	2-12	1.20-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-3
	19-42	10-18	1.20-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	42-60	0-15	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
Coloma----------	0-10	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-6.5	Low-----------	0.17	5	2	<1
	10-34	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.0	Low-----------	0.15			
	34-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
7----------------	0-7	0-15	1.35-1.50	2.0-20	0.07-0.15	5.6-7.8	Low-----------	0.17	5	2	---
Glendora	7-60	0-10	1.40-1.65	6.0-20	0.05-0.11	5.6-7.8	Low-----------	0.17			
8A---------------	0-8	1-6	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	Low-----------	0.17	5	2	.5-2
Morocco	8-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	Low-----------	0.15			
9B, 9C-----------	0-9	2-5	1.50-1.65	6.0-20	0.04-0.09	5.1-7.3	Low-----------	0.15	5	1	.5-2
Plainfield	9-20	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.15			
	20-60	0-4	1.50-1.70	6.0-20	0.03-0.07	4.5-6.5	Low-----------	0.15			
10*:											
Aquents.											
Histosols.											
11---------------	0-48	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	2	2	55-75
Edwards	48-60	---	---	---	---	7.4-8.4	-------------	----			
12B*, 12C*:											
Spinks----------	0-19	2-15	1.20-1.60	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	19-30	3-15	1.20-1.60	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	30-60	0-15	1.20-1.50	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
Oshtemo---------	0-19	2-10	1.20-1.60	2.0-6.0	0.10-0.15	5.1-6.5	Low-----------	0.24	5	3	.5-3
	19-42	10-18	1.20-1.60	2.0-6.0	0.12-0.19	5.1-6.5	Low-----------	0.24			
	42-60	0-15	1.20-1.50	>20	0.02-0.04	7.4-8.4	Low-----------	0.10			
17A--------------	0-10	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.17	5	1	.5-1
Brems	10-60	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	Low-----------	0.17			
18B, 18C---------	0-15	5-12	1.40-1.60	2.0-6.0	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
Ormas	15-40	3-10	1.45-1.60	2.0-6.0	0.07-0.09	5.6-6.5	Low-----------	0.17			
	40-55	18-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low-----------	0.32			
	55-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low-----------	0.15			
19A--------------	0-26	2-10	1.40-1.60	6.0-20	0.07-0.11	5.6-7.3	Low-----------	0.17	5	2	.5-2
Ottokee	26-60	1-12	1.50-1.70	6.0-20	0.06-0.10	5.6-7.3	Low-----------	0.17			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
20B, 20C---------Spinks	0-19	2-15	1.20-1.60	6.0-20	0.08-0.10	5.1-7.3	Low-----------	0.17	5	2	2-4
	19-30	3-15	1.20-1.60	2.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
	30-60	0-15	1.20-1.50	2.0-6.0	0.04-0.08	5.6-7.8	Low-----------	0.17			
22A, 22B, 22C----Kalamazoo	0-10	8-25	1.10-1.65	0.6-2.0	0.16-0.22	5.1-7.3	Low-----------	0.32	4	5	1-3
	10-39	18-35	1.25-1.70	0.6-2.0	0.10-0.18	5.1-7.3	Moderate------	0.32			
	39-60	0-10	1.50-1.65	6.0-20	0.01-0.03	7.4-8.4	Low-----------	0.10			
24A--------------Bronson	0-9	2-15	1.14-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low-----------	0.24	4	3	1-3
	9-43	10-20	1.26-1.59	2.0-6.0	0.12-0.18	5.1-7.3	Low-----------	0.24			
	43-60	0-10	1.26-1.59	2.0-6.0	0.06-0.08	5.1-7.3	Low-----------	0.17			
26---------------Gilford	0-14	10-20	1.50-1.70	2.0-6.0	0.13-0.15	5.6-7.3	Low-----------	0.20	4	3	2-4
	14-35	8-17	1.60-1.80	2.0-6.0	0.12-0.14	5.6-7.3	Low-----------	0.20			
	35-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	Low-----------	0.15			
27---------------Adrian	0-36	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	55-75
	36-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	----			
28---------------Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	4.5-7.8	--------------	----	2	2	>70
32---------------Colwood	0-14	5-26	1.15-1.60	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.28	5	5	3-8
	14-35	18-35	1.30-1.60	0.6-2.0	0.17-0.22	6.1-8.4	Moderate------	0.43			
	35-60	0-12	1.20-1.45	0.6-2.0	0.12-0.22	7.4-8.4	Low-----------	0.43			
33B--------------Tuscola	0-14	8-20	1.30-1.65	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.32	5	5	1-2
	14-30	18-35	1.30-1.70	0.6-2.0	0.15-0.20	5.6-7.3	Moderate------	0.32			
	30-60	5-45	1.30-1.70	0.6-2.0	0.14-0.18	7.4-8.4	Low-----------	0.32			
36C, 36D, 36E----Oakville	0-9	0-10	1.30-1.55	6.0-20	0.07-0.09	5.6-7.3	Low-----------	0.15	5	1	.5-2
	9-60	0-10	1.30-1.65	6.0-20	0.06-0.10	5.6-7.3	Low-----------	0.15			
37A--------------Thetford	0-11	2-15	1.25-1.41	2.0-6.0	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	1-4
	11-45	8-18	1.35-1.45	2.0-6.0	0.08-0.13	5.6-7.8	Low-----------	0.17			
	45-60	0-10	1.25-1.50	6.0-20	0.05-0.08	7.4-8.4	Low-----------	0.17			
38---------------Napoleon	0-16	---	0.30-0.40	0.6-6.0	0.45-0.55	<4.5	--------------	----	2	7	70-90
	16-60	---	0.10-0.20	0.6-6.0	0.45-0.55	<4.5	--------------	----			
39A--------------Matherton	0-13	10-20	1.30-1.65	2.0-6.0	0.13-0.24	5.6-7.3	Low-----------	0.28	4	5	2-4
	13-25	20-35	1.40-1.70	0.6-2.0	0.16-0.18	5.6-7.3	Low-----------	0.28			
	25-60	0-10	1.50-1.65	>6.0	0.02-0.04	7.4-8.4	Low-----------	0.10			
43---------------Sloan	0-10	15-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low-----------	0.37	5	6	3-6
	10-50	22-35	1.25-1.55	0.2-2.0	0.15-0.19	6.1-8.4	Moderate------	0.37			
	50-60	10-30	1.20-1.50	0.2-2.0	0.13-0.18	6.6-8.4	Low-----------	0.37			
45B--------------Covert	0-8	2-10	1.25-1.55	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.15	5	1	1-2
	8-35	2-10	1.25-1.60	6.0-20	0.05-0.08	4.5-7.3	Low-----------	0.15			
	35-60	0-10	1.45-1.65	6.0-20	0.04-0.07	5.1-7.3	Low-----------	0.15			
47A--------------Selfridge	0-33	2-15	1.25-1.40	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.15	5	2	1-3
	33-35	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low-----------	0.15			
	35-60	18-35	1.50-1.90	0.2-0.6	0.10-0.14	7.4-8.4	Low-----------	0.37			
48A*:											
Pipestone--------	0-14	2-12	1.20-1.60	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.15	5	1	3-4
	14-26	2-12	1.20-1.60	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.17			
	26-60	2-12	1.20-1.60	6.0-20	0.05-0.07	5.1-7.3	Low-----------	0.17			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
48A*:											
Kingsville------	0-8	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.0	Low-----------	0.17	5	2	3-6
	8-30	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.5	Low-----------	0.17			
	30-60	2-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
49B-------------- Grattan	0-14	0-10	1.35-1.40	6.0-20	0.07-0.09	4.5-6.5	Low-----------	0.15	5	1	---
	14-26	0-10	1.30-1.60	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
	26-60	0-10	1.40-1.55	6.0-20	0.02-0.04	5.6-7.3	Low-----------	0.15			
50B, 50C--------- Metea	0-10	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	.5-2
	10-26	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.17			
	26-28	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-6.5	Low-----------	0.32			
	28-36	27-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	36-60	15-24	1.70-1.95	0.2-0.6	0.05-0.12	7.4-8.4	Low-----------	0.32			
51--------------- Kingsville	0-8	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.0	Low-----------	0.17	5	2	3-6
	8-30	2-12	1.20-1.50	6.0-20	0.07-0.12	4.5-6.5	Low-----------	0.17			
	30-60	2-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
52B, 52C, 52D, 52E------------ Riddles	0-8	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low-----------	0.24	5	3	.5-2
	8-17	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate-----	0.32			
	17-45	20-35	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.32			
	45-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low-----------	0.32			
53B-------------- Capac	0-12	10-18	1.40-1.70	0.6-2.0	0.18-0.20	5.6-7.3	Low-----------	0.32	5	5	1-3
	12-27	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low-----------	0.32			
	27-60	10-35	1.50-1.70	0.2-0.6	0.14-0.16	7.4-8.4	Low-----------	0.32			
54--------------- Palms	0-24	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	--------------	----	2	2	>75
	24-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low-----------	----			
56--------------- Pewamo	0-11	27-40	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate-----	0.28	5	6	3-10
	11-36	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate-----	0.28			
	36-60	30-40	1.50-1.75	0.2-0.6	0.14-0.18	7.4-8.4	Moderate-----	0.28			
60--------------- Belleville	0-14	3-12	0.90-1.60	6.0-20	0.10-0.12	6.1-7.8	Low-----------	0.17	5	2	.5-3
	14-32	2-12	1.45-1.70	6.0-20	0.06-0.10	6.1-8.4	Low-----------	0.17			
	32-60	25-35	1.45-1.95	0.2-0.6	0.14-0.20	7.4-8.4	Moderate-----	0.32			
61B*:											
Udipsamments.											
Udorthents.											
62*. Pits											
64B*:											
Urban land.											
Coloma----------	0-10	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-6.5	Low-----------	0.17	5	2	<1
	10-34	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.0	Low-----------	0.15			
	34-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low-----------	0.15			
65B*:											
Urban land.											
Brems-----------	0-10	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.17	5	1	.5-1
	10-60	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	Low-----------	0.17			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
66*:											
Algansee--------	0-7	5-15	1.35-1.50	2.0-6.0	0.12-0.14	5.6-7.3	Low-----------	0.24	5	3	1-4
	7-60	0-18	1.40-1.65	6.0-20	0.05-0.07	5.6-7.8	Low-----------	0.17			
Cohoctah--------	0-10	5-20	1.20-1.60	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.28	5	3	1-4
	10-60	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
3B, 3C: Coloma	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
4B: Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	---	---	High	High	High.
6B, 6C: Oshtemo	B	None	---	---	>6.0	---	---	---	---	Low	Low	High.
6D*, 6E*:												
Oshtemo	B	None	---	---	>6.0	---	---	---	---	Low	Low	High.
Coloma	A	None	---	---	>6.0	---	---	---	---	Low	Low	Moderate.
7: Glendora	A/D	Frequent	Long	Jan-Dec	0-1.0	Apparent	Nov-Jun	---	---	Moderate	High	Moderate.
8A: Morocco	B	None	---	---	1.0-2.0	Apparent	Jan-Apr	---	---	Moderate	Low	High.
9B, 9C: Plainfield	A	None	---	---	>6.0	---	---	---	---	Low	Low	High.
10*:												
Aquents.												
Histosols.												
11: Edwards	B/D	None	---	---	+1-0.5	Apparent	Sep-Jun	4-12	25-30	High	High	Low.
12B*, 12C*:												
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low	Low.
Oshtemo	B	None	---	---	>6.0	---	---	---	---	Low	Low	High.
17A: Brems	A	None	---	---	2.0-3.0	Apparent	Jan-Apr	---	---	Low	Low	High.
18B, 18C: Ormas	B	None	---	---	>6.0	---	---	---	---	Moderate	Low	Moderate.
19A: Ottokee	A	None	---	---	2.0-3.5	Apparent	Jan-Apr	---	---	Low	Low	Low.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
20B, 20C----------- Spinks	A	None---------	---	---	>6.0	---	---	---	---	Low-------	Low-------	Low.
22A, 22B, 22C----- Kalamazoo	B	None---------	---	---	>6.0	---	---	---	---	Moderate	Low-------	Low.
24A----------------- Bronson	B	None---------	---	---	2.0-3.5	Apparent	Nov-May	---	---	High------	Low-------	High.
26------------------ Gilford	B/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	---	---	High------	High------	Moderate.
27------------------ Adrian	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	---	29-33	High------	High------	Moderate.
28------------------ Houghton	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	1-4	55-60	High------	High------	Moderate.
32------------------ Colwood	B/D	None---------	---	---	+1-1.0	Apparent	Oct-May	---	---	High------	High------	Low.
33B----------------- Tuscola	B	None---------	---	---	2.0-3.5	Apparent	Nov-Apr	---	---	High------	Moderate	Low.
36C, 36D, 36E----- Oakville	A	None---------	---	---	>6.0	---	---	---	---	Low-------	Low-------	Moderate.
37A----------------- Thetford	A	None---------	---	---	1.0-2.0	Apparent	Feb-May	---	---	Moderate	Low-------	Moderate.
38------------------ Napoleon	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	22-26	50-59	High------	Moderate	High.
39A----------------- Matherton	B	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High------	Moderate	Low.
43------------------ Sloan	B/D	Frequent----	Brief------	Nov-Jun	0-1.0	Apparent	Nov-Jun	---	---	High------	High------	Low.
45B----------------- Covert	A	None---------	---	---	2.0-3.5	Apparent	Nov-Apr	---	---	Low-------	Low-------	Moderate.
47A----------------- Selfridge	B	None---------	---	---	1.0-2.0	Perched	Nov-May	---	---	High------	High------	Low.
48A*:												
Pipestone----------	B	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	---	Moderate	Low-------	Moderate.
Kingsville---------	A/D	None---------	---	---	+1-1.0	Apparent	Jan-Apr	---	---	Moderate	High------	High.

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Uncoated steel	Concrete
					Ft			In	In			
49B----------------Grattan	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low------	High.
50B, 50C----------Metea	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Moderate	Moderate.
51-----------------Kingsville	A/D	None--------	---	---	+1-1.0	Apparent	Jan-Apr	---	---	Moderate	High-----	High.
52B, 52C, 52D, 52E--------------Riddles	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Moderate	Moderate.
53B----------------Capac	C	None--------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	High-----	Low.
54-----------------Palms	A/D	None--------	---	---	+1-1.0	Apparent	Nov-May	2-4	25-32	High-----	High-----	Moderate.
56-----------------Pewamo	C/D	None--------	---	---	+1-1.0	Apparent	Dec-May	---	---	High-----	High-----	Low.
60-----------------Belleville	B/D	None--------	---	---	+1-1.0	Apparent	Nov-May	---	---	High-----	High-----	Low.
61B*: Udipsamments.												
Udorthents.												
62*. Pits												
64B*: Urban land.												
Coloma-----------	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low------	Moderate.
65B*: Urban land.												
Brems------------	A	None--------	---	---	2.0-3.0	Apparent	Jan-Apr	---	---	Low------	Low------	High.
66*: Algansee---------	B	Frequent----	Long------	Nov-May	1.0-2.0	Apparent	Nov-May	---	---	Moderate	Low------	Low.
Cohoctah---------	B/D	Frequent----	Brief to long.	Nov-Apr	0-1.0	Apparent	Sep-May	---	---	High-----	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Algansee	Mixed, mesic Aquic Udipsamments
Aquents	Mixed, nonacid, mesic Aquents
Belleville	Sandy over loamy, mixed, mesic Typic Haplaquolls
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Brems	Mixed, mesic Aquic Udipsamments
Bronson	Coarse-loamy, mixed, mesic Aquic Hapludalfs
Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Coloma	Mixed, mesic Alfic Udipsamments
Colwood	Fine-loamy, mixed, mesic Typic Haplaquolls
Covert	Sandy, mixed, mesic Entic Haplorthods
Edwards	Marly, euic, mesic Limnic Medisaprists
*Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Glendora	Mixed, mesic Mollic Psammaquents
Grattan	Sandy, mixed, mesic Entic Haplorthods
Histosols	Euic, mesic Histosols
Houghton	Euic, mesic Typic Medisaprists
Kalamazoo	Fine-loamy, mixed, mesic Typic Hapludalfs
Kingsville	Mixed, mesic Mollic Psammaquents
*Matherton	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Udollic Ochraqualfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Morocco	Mixed, mesic Aquic Udipsamments
Napoleon	Dysic, mesic Typic Medihemists
Oakville	Mixed, mesic Typic Udipsamments
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Oshtemo	Coarse-loamy, mixed, mesic Typic Hapludalfs
Ottokee	Mixed, mesic Aquic Udipsamments
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
*Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Sloan	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
*Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Tuscola	Fine-loamy, mixed, mesic Aquic Hapludalfs
Udipsamments	Mixed, mesic Udipsamments
Udorthents	Loamy, mixed, nonacid, mesic Udorthents

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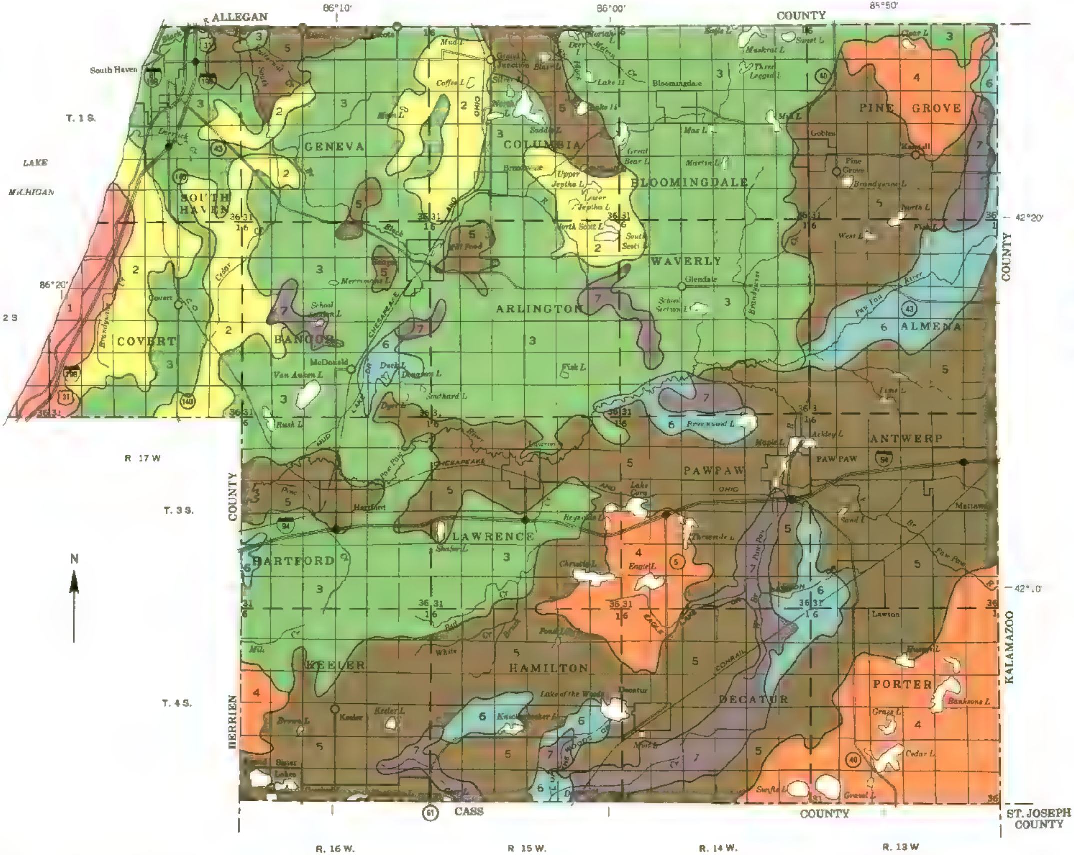


LEGEND*

1	OAKVILLE association: Undulating to very steep, well drained, sandy soils on beach ridges and dunes
2	KINGSVILLE-COVERT-PIPESTONE association: Nearly level and undulating, poorly drained to moderately well drained, sandy soils on lake plains and outwash plains
3	CAPAC-RIDDLES-SELFRIDGE association: Nearly level to hilly, somewhat poorly drained and well drained, loamy and sandy soils on till plains, moraines, and lake plains
4	OSHTEMO-KALAMAZOO association: Nearly level to gently rolling, well drained, loamy soils on glacial outwash plains
5	COLOMA-SPINKS-OSHTEMO association: Nearly level to hilly, somewhat excessively drained and well drained, sandy and loamy soils on outwash plains and moraines
6	GILFORD association: Nearly level, very poorly drained loamy soils on outwash plains
7	ADRIAN-EDWARDS-HOUGHTON association: Nearly level, very poorly drained, mucky soils in old glacial lakebeds, on flood plains, and in drainageways

*The texture terms given in the descriptive headings refer to the surface layer of the major soils in each association

COMPILED 1984

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN TECHNOLOGICAL UNIVERSITY

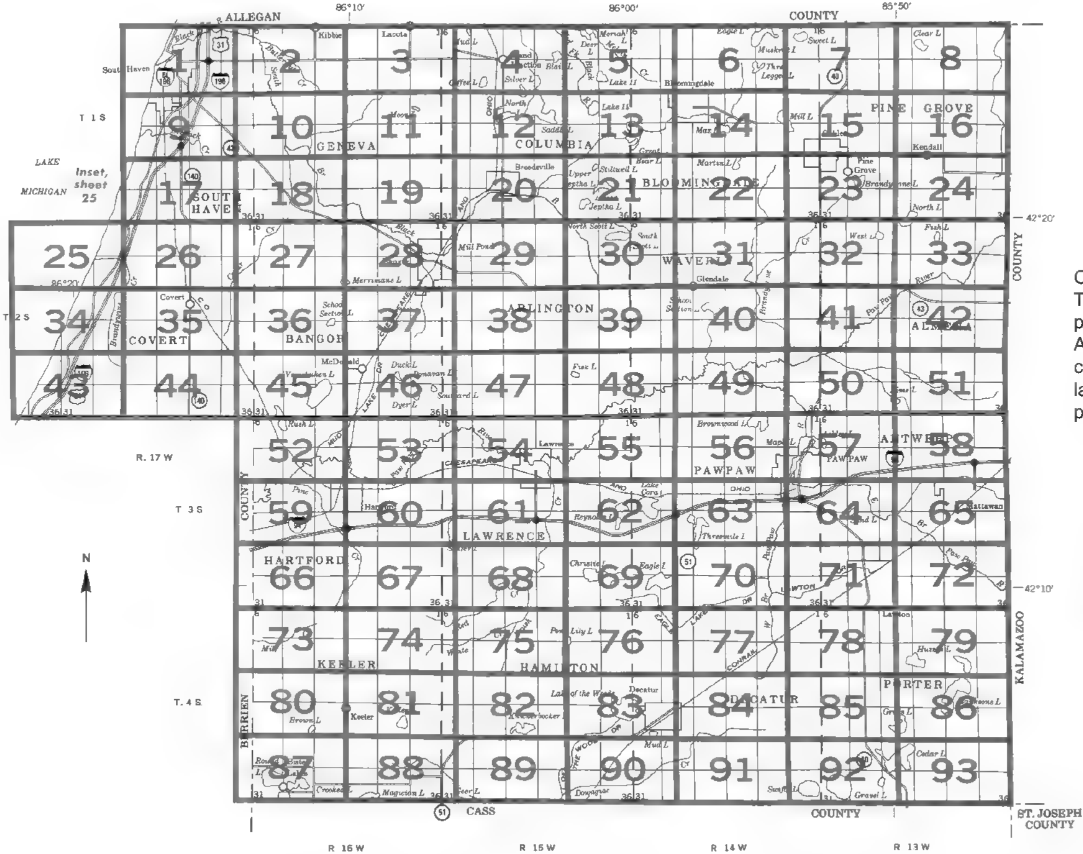
GENERAL SOIL MAP
VAN BUREN COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read: This soil survey map is compiled on 1979 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

VAN BUREN COUNTY, MICHIGAN

Scale 1 190 080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas.

SYMBOL	NAME
3B	Coloma loamy sand, 0 to 6 percent slopes
3C	Coloma loamy sand, 6 to 12 percent slopes
4B	Blount silt loam, 0 to 4 percent slopes
6B	Oshtemo sandy loam, 0 to 6 percent slopes
6C	Oshtemo sandy loam, 6 to 12 percent slopes
6D	Oshtemo-Coloma loamy sands, 12 to 18 percent slopes
6E	Oshtemo-Coloma loamy sands, 18 to 25 percent slopes
7	Glendora sandy loam
8A	Morocco loamy sand, 0 to 2 percent slopes
9B	Plainfield sand, 0 to 6 percent slopes
9C	Plainfield sand, 6 to 12 percent slopes
10	Aquents and Histosols, ponded
11	Edwards muck
12B	Spinks-Oshtemo complex, 0 to 6 percent slopes
12C	Spinks-Oshtemo complex, 6 to 12 percent slopes
17A	Brems sand, 0 to 2 percent slopes
18B	Ormas loamy sand, 0 to 6 percent slopes
18C	Ormas loamy sand, 6 to 12 percent slopes
19A	Ottokee loamy fine sand, 0 to 3 percent slopes
20B	Spinks loamy sand, 0 to 6 percent slopes
20C	Spinks loamy sand, 6 to 12 percent slopes
22A	Kalamazoo loam, 0 to 2 percent slopes
22B	Kalamazoo loam, 2 to 6 percent slopes
22C	Kalamazoo loam, 6 to 12 percent slopes
24A	Bronson sandy loam, 0 to 3 percent slopes
26	Gilford sandy loam
27	Adrian muck
28	Houghton muck
32	Colwood silt loam
33B	Tuscola silt loam, 0 to 4 percent slopes
36C	Oakville fine sand, 2 to 12 percent slopes
36D	Oakville fine sand, 12 to 25 percent slopes
36E	Oakville fine sand, 25 to 60 percent slopes
37A	Thetford loamy sand, 0 to 2 percent slopes
38	Napoleon mucky peat
39A	Matherton loam, 0 to 2 percent slopes
43	Sloan loam
45B	Covert sand, 0 to 4 percent slopes
47A	Selfridge loamy sand, 0 to 3 percent slopes
48A	Pipestone-Kingsville complex, 0 to 3 percent slopes
49B	Grattan sand, 0 to 6 percent slopes
50B	Metea loamy fine sand, 1 to 6 percent slopes
50C	Metea loamy fine sand, 6 to 12 percent slopes
51	Kingsville loamy sand
52B	Riddles sandy loam, 1 to 6 percent slopes
52C	Riddles sandy loam, 6 to 12 percent slopes
52D	Riddles sandy loam, 12 to 18 percent slopes
52E	Riddles sandy loam, 18 to 25 percent slopes
53B	Capac loam, 1 to 5 percent slopes
54	Palms muck
56	Pewamo silty clay loam
60	Belleville loamy sand
61B	Udipsamments and Udorthents, 0 to 4 percent slopes
62	Pits
64B	Urban land-Coloma complex, 0 to 6 percent slopes
65B	Urban land-Brems complex, 0 to 4 percent slopes
66	Algansee-Cohoctah complex

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 12B 52C

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

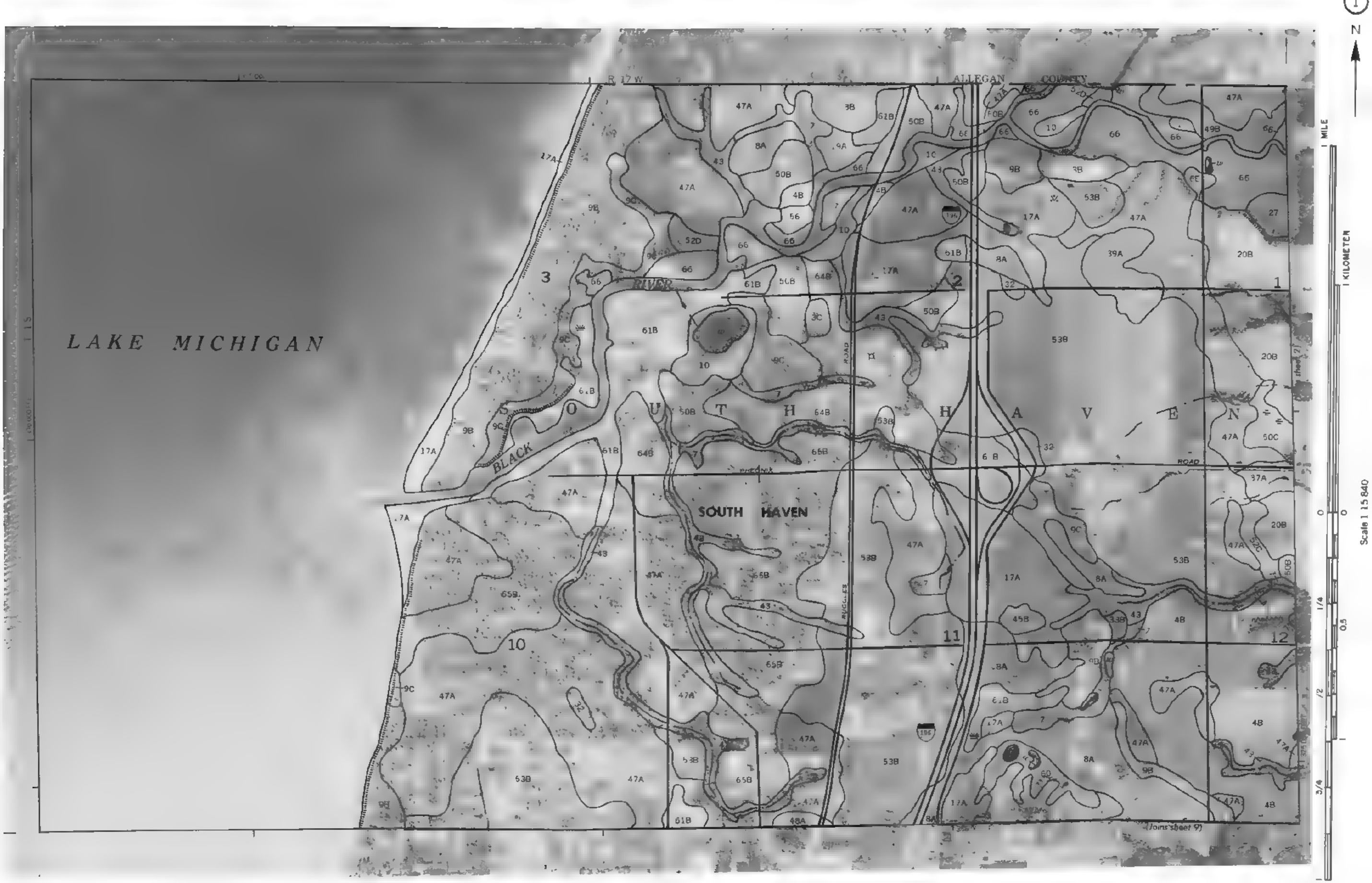
DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) — S

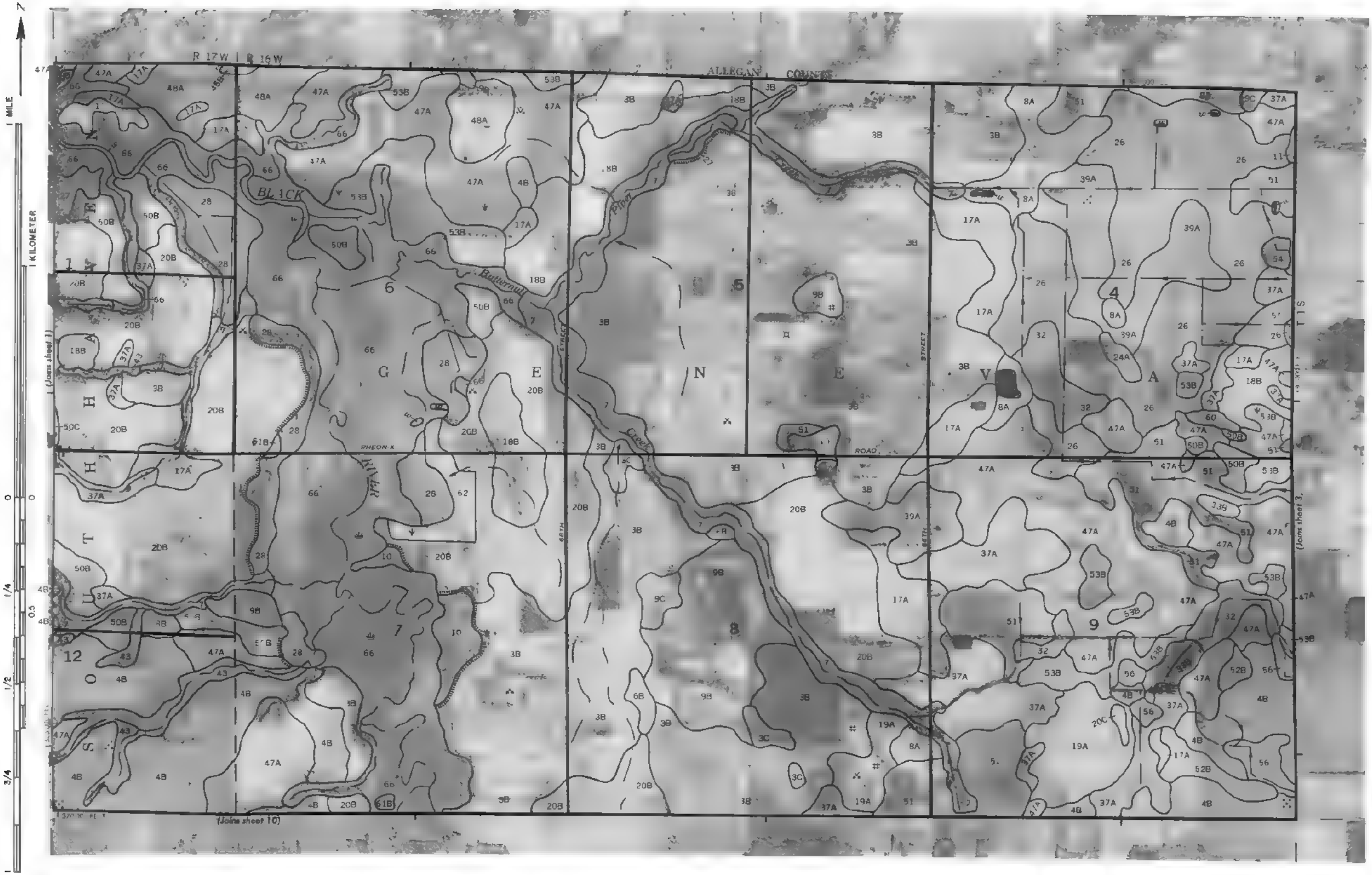
MISCELLANEOUS

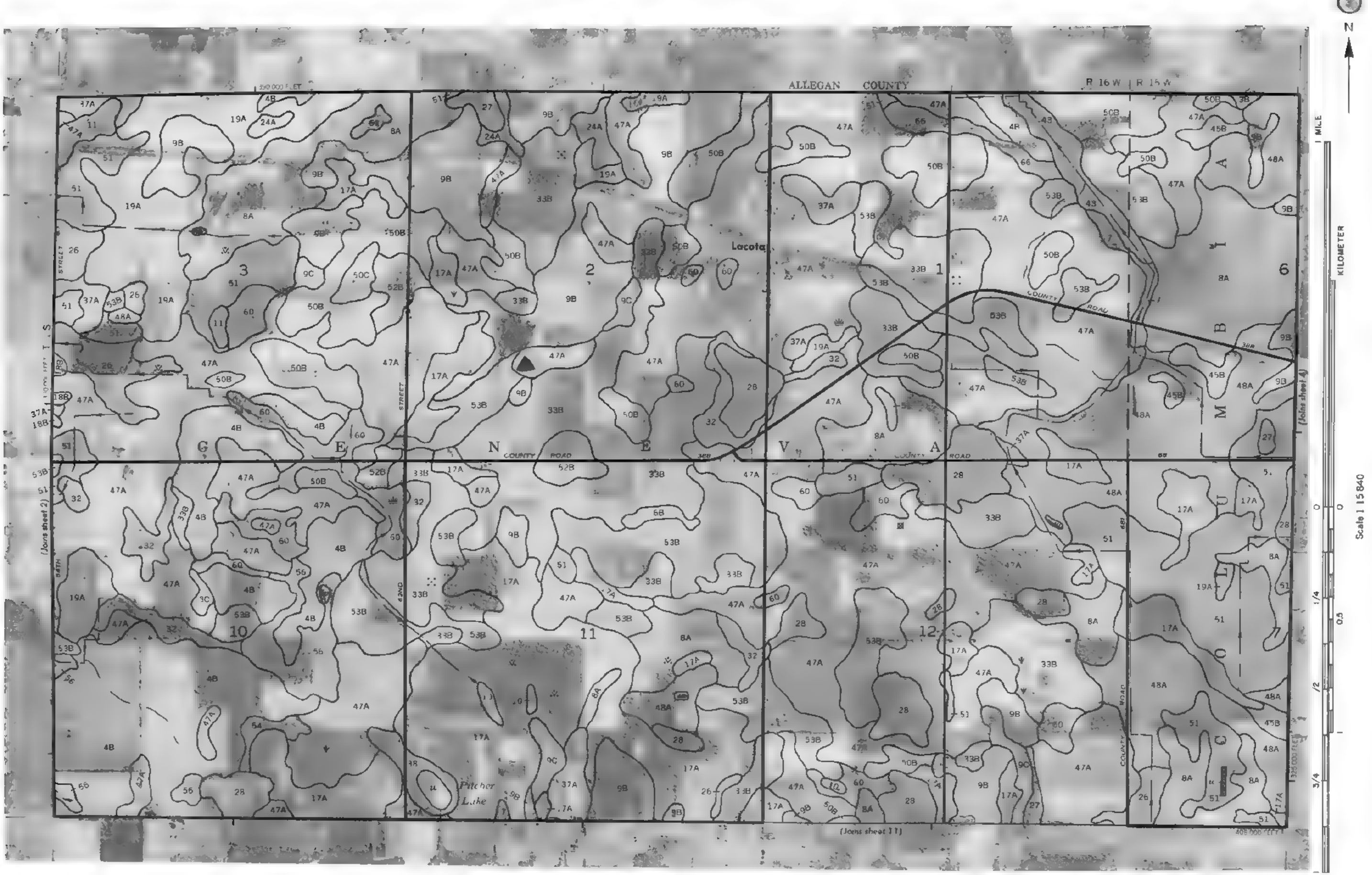
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot
- Sanitary landfill < 10 acres
- Colluvium in depressions > 1 foot
- Loamy spot < 3 acres
- Wind blown area < 3 acres

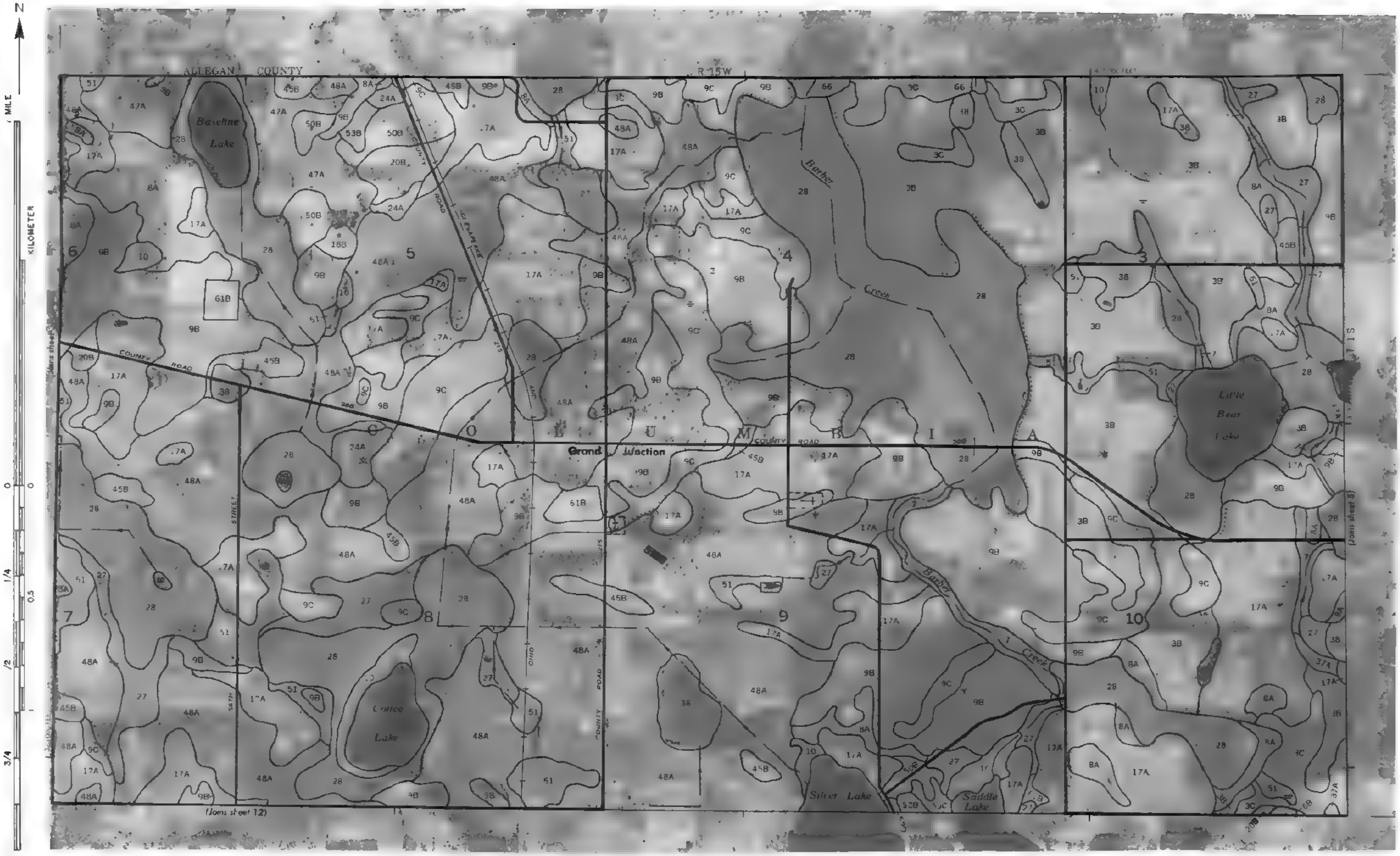
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 1

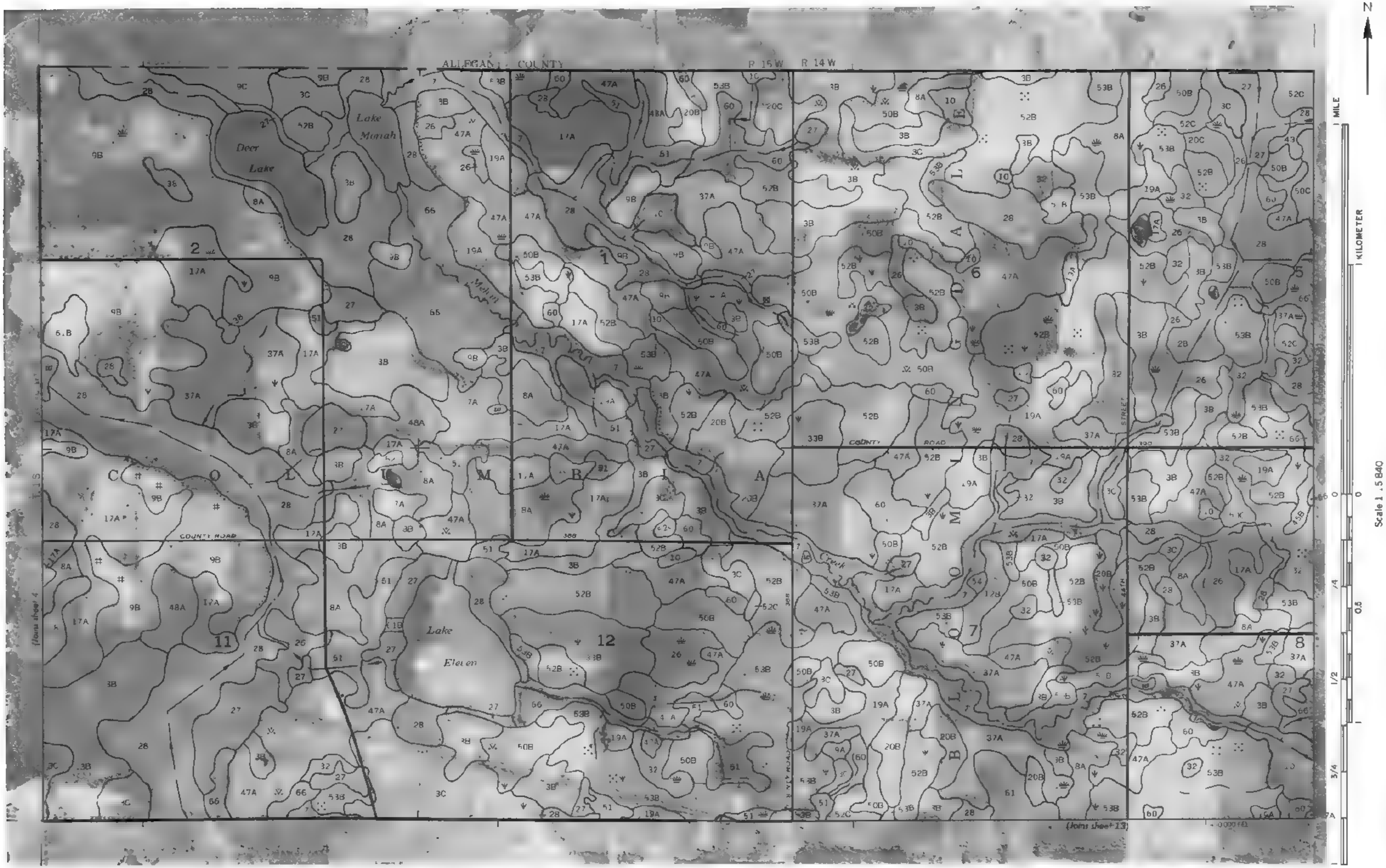


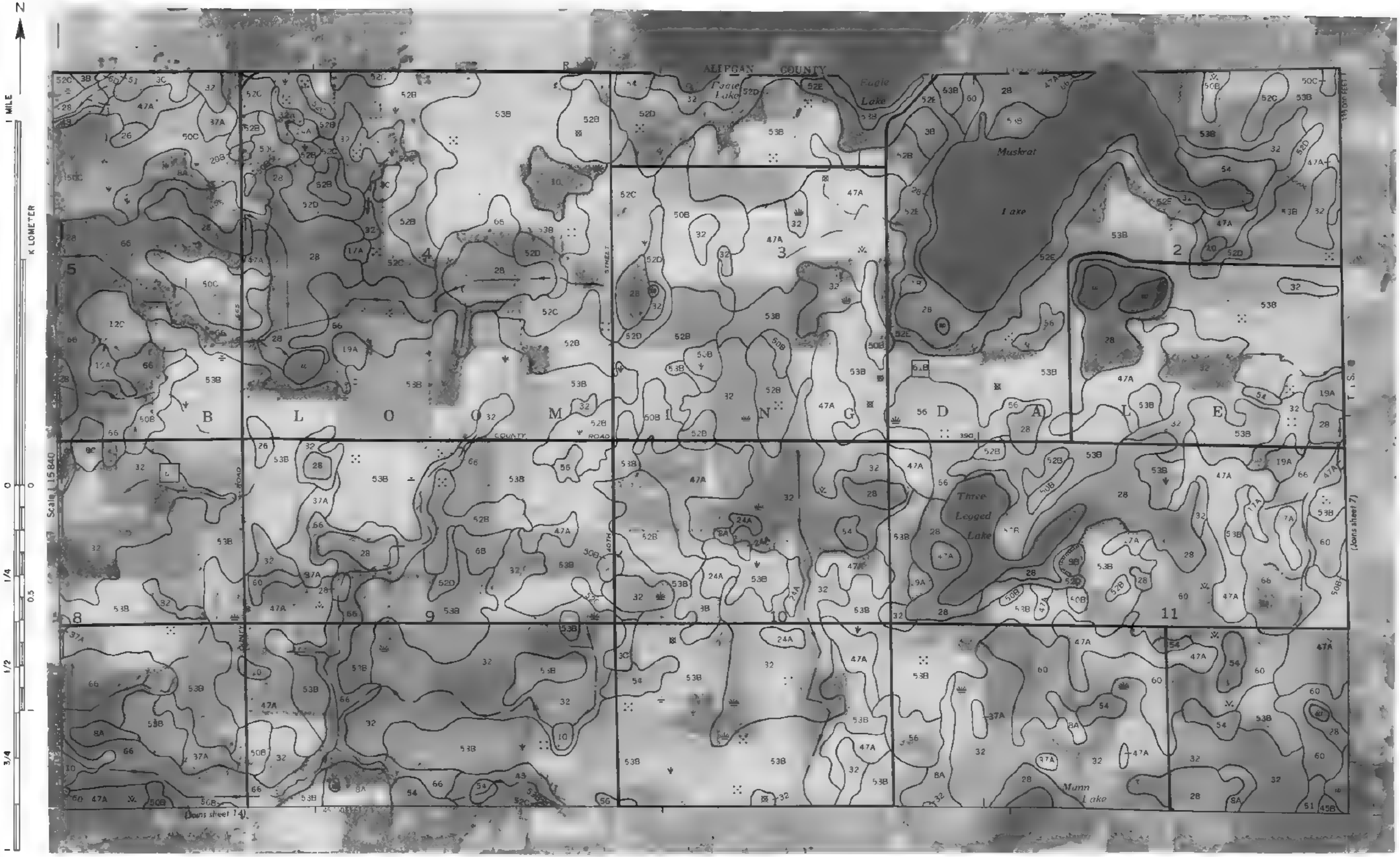
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 2

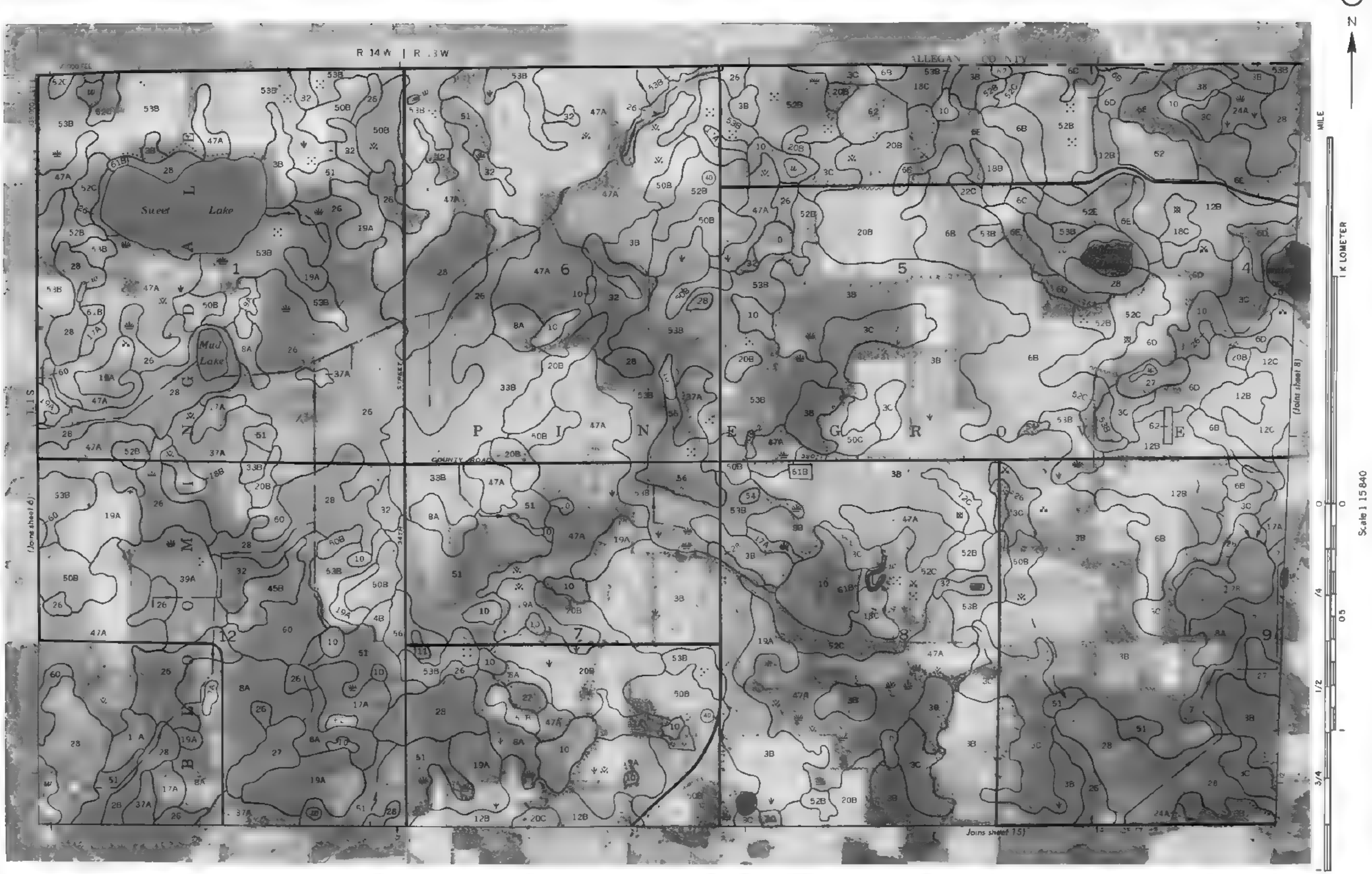



ALLEGAN COUNTY
R 16 W
R 15 W
Lacota
Pitcher Lake
COUNTY ROAD
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 11)
N
1 MILE
KILOMETER
Scale 1:15 840

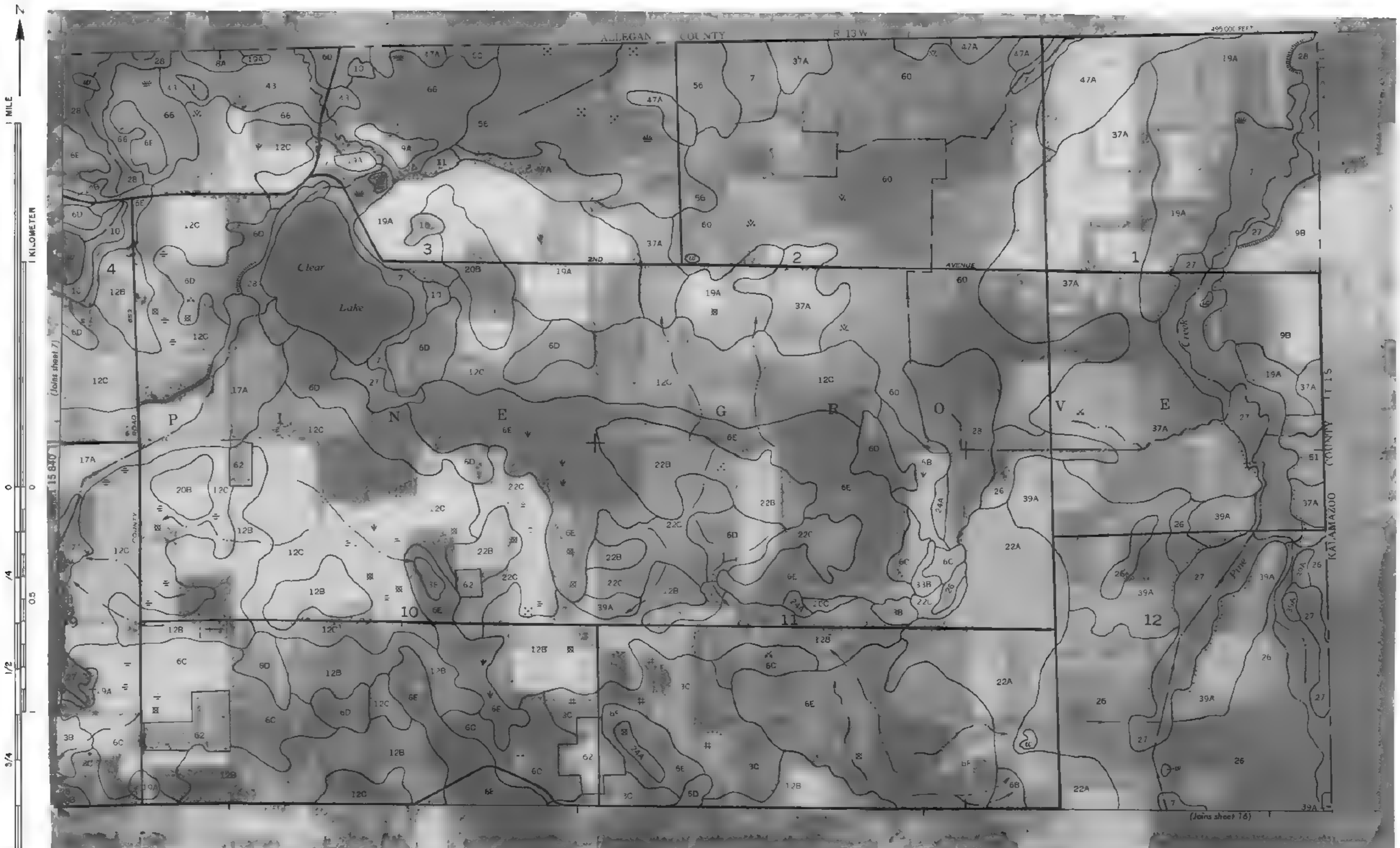

N
1 MILE
KILOMETER
0
1/4
1/2
3/4
0.5
1
ALLEGAN COUNTY
R 15 W
Baseline Lake
COLUMBIA
Grand Junction
COUNTY ROAD
Barber Creek
Little Bear Lake
Cottee Lake
Silver Lake
Saddle Lake
STREET
COUNTY ROAD
(Joins sheet 12)
(Joins sheet 8)
3
4
5
6
7
8
9
10


ALLEGAN COUNTY
R 15 W
R 14 W
Deer Lake
Lake Minnah
Lake Eleven
COLUMBIA
BLOOMINGDALE
COUNTY ROAD
(Joins sheet 4)
(Joins sheet 13)
N
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
KILOMETER
Scale 1:15 840
ALLEGAN COUNTY
Eagle Lake
Muskrat Lake
Three Legged Lake
Mann Lake
B L O O M I N G D A L E
(Joins sheet 7)
(Joins sheet 14)


7
N
R 14 W | R 13 W
ALLEGAN COUNTY
Sweet Lake
Mud Lake
PINE GROVE
ALMENA
BLOOMINGDALE
STREET
COUNTY ROAD
1
4
5
6
7
8
9
12
(Joins sheet 6)
(Joins sheet 8)
Joins sheet 15)
40
T 1 S
MILE
1 KILOMETER
0
1/4
1/2
3/4
0
0.5
Scale 1:15 840

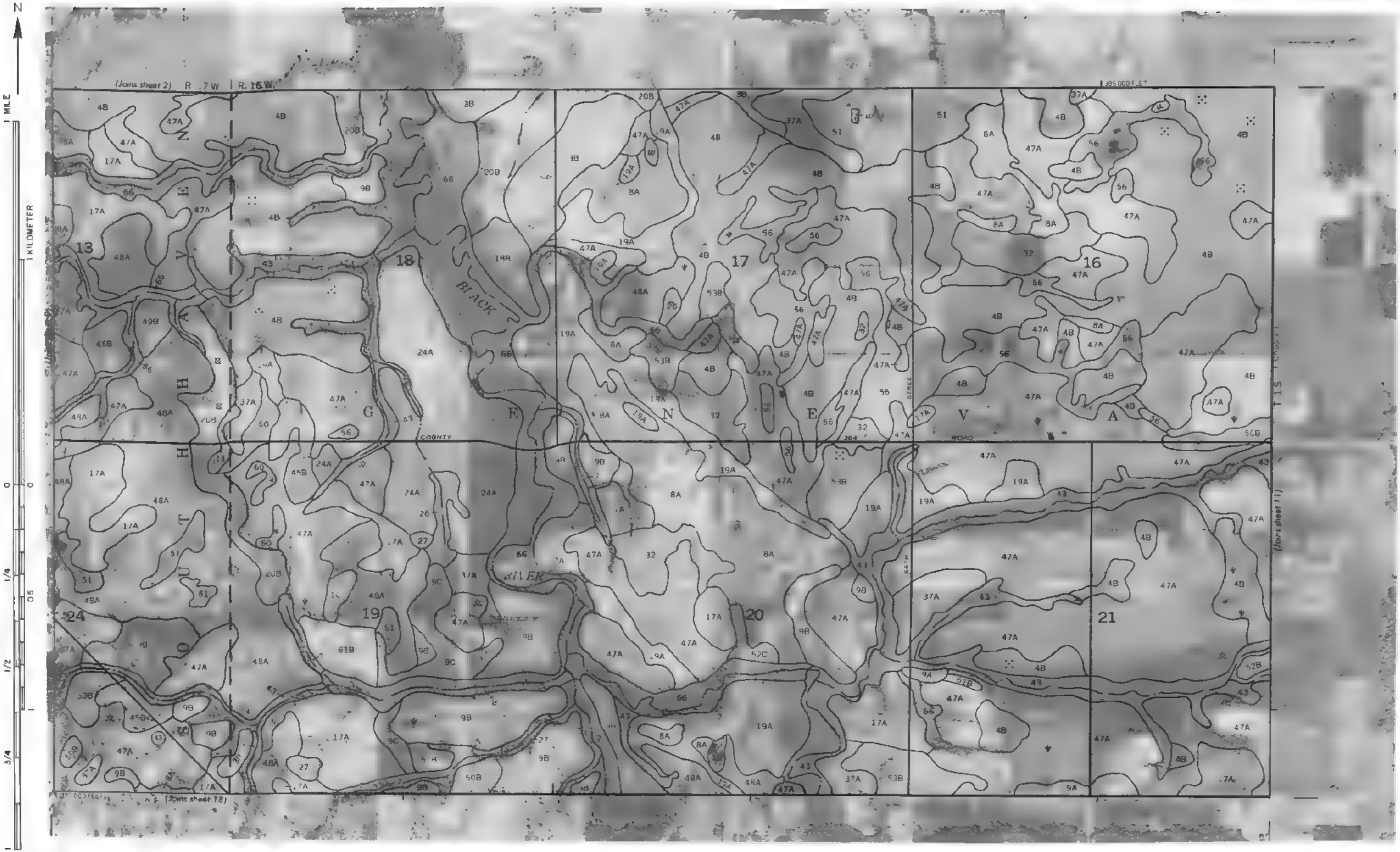
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 8

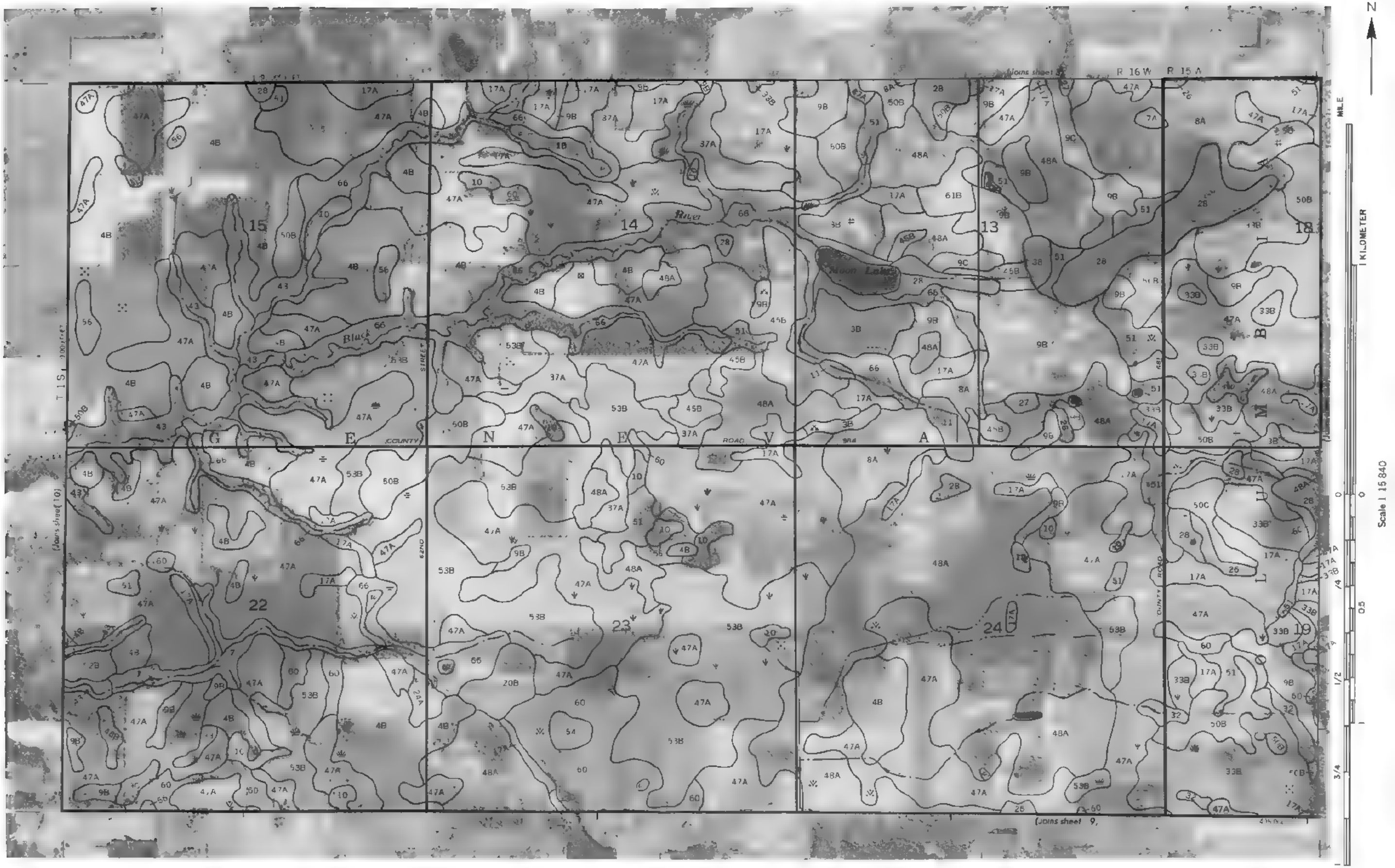


9


N
LAKE
MICHIGAN
S O U T H H A V E N
R 17 W
T 1 S
(Joins sheet 1)
(Joins sheet 10)
(Joins sheet 17)
16
15
14
13
21
22
23
24
1 MILE
1 KILOMETER
Scale 1:15 840

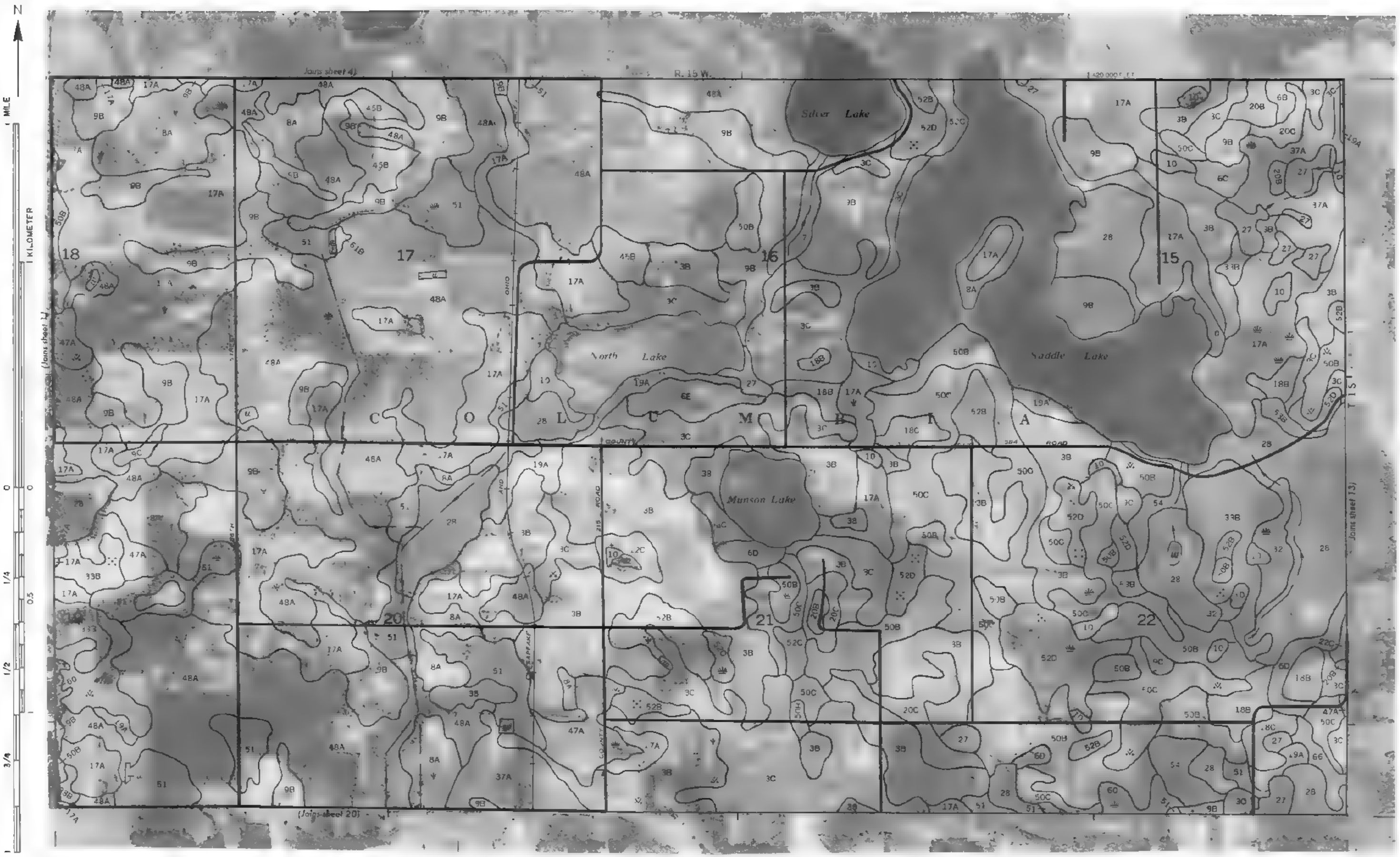
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 10

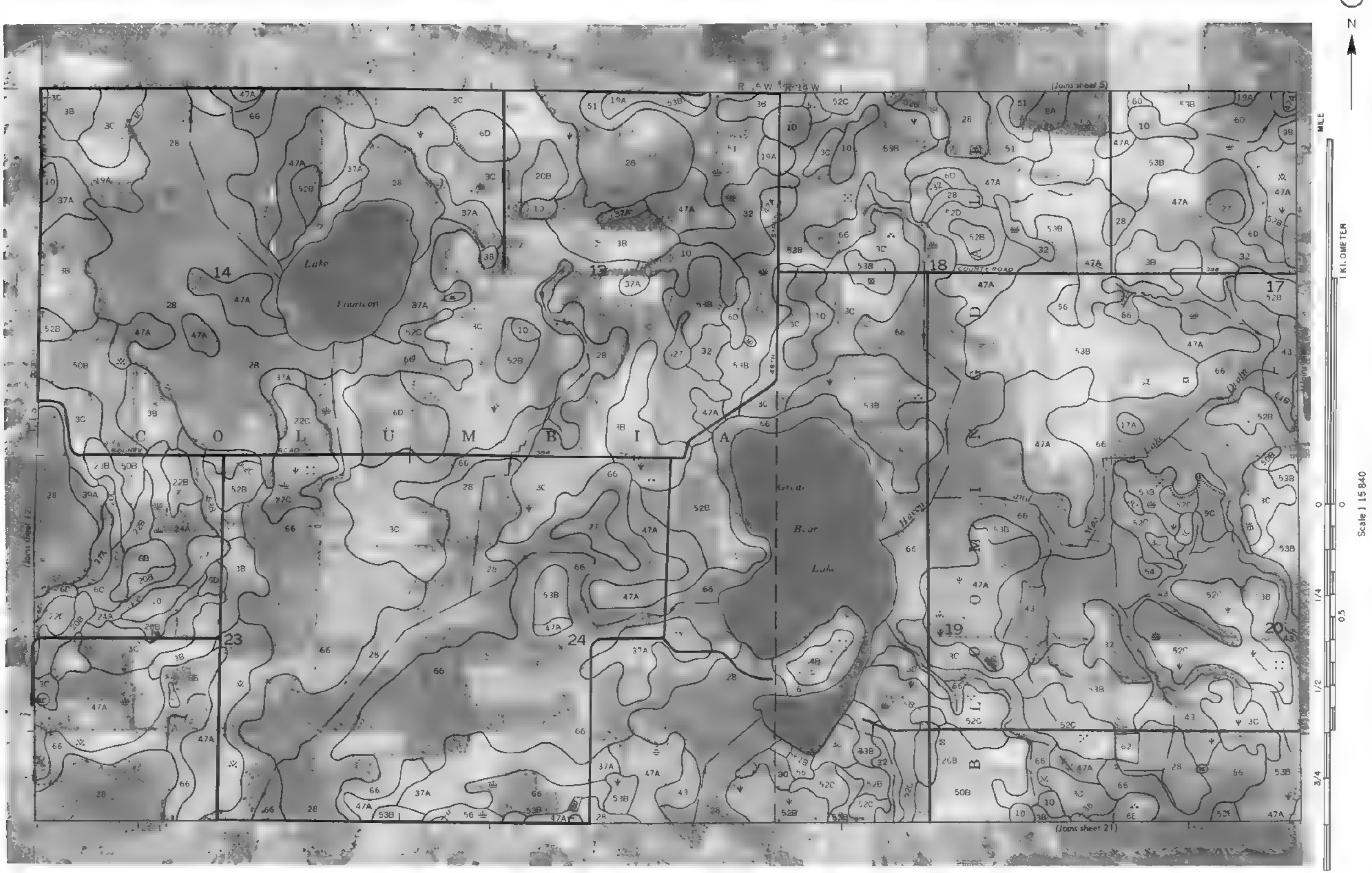



N
R 16 W
R 15 W
T 1 S
15
14
13
18
22
23
24
19
Black
River
Moon Lake
COUNTY
ROAD
STREET
(Joins sheet 10)
(Joins sheet 9)
MILE
1 KILOMETER
Scale 1:15 840

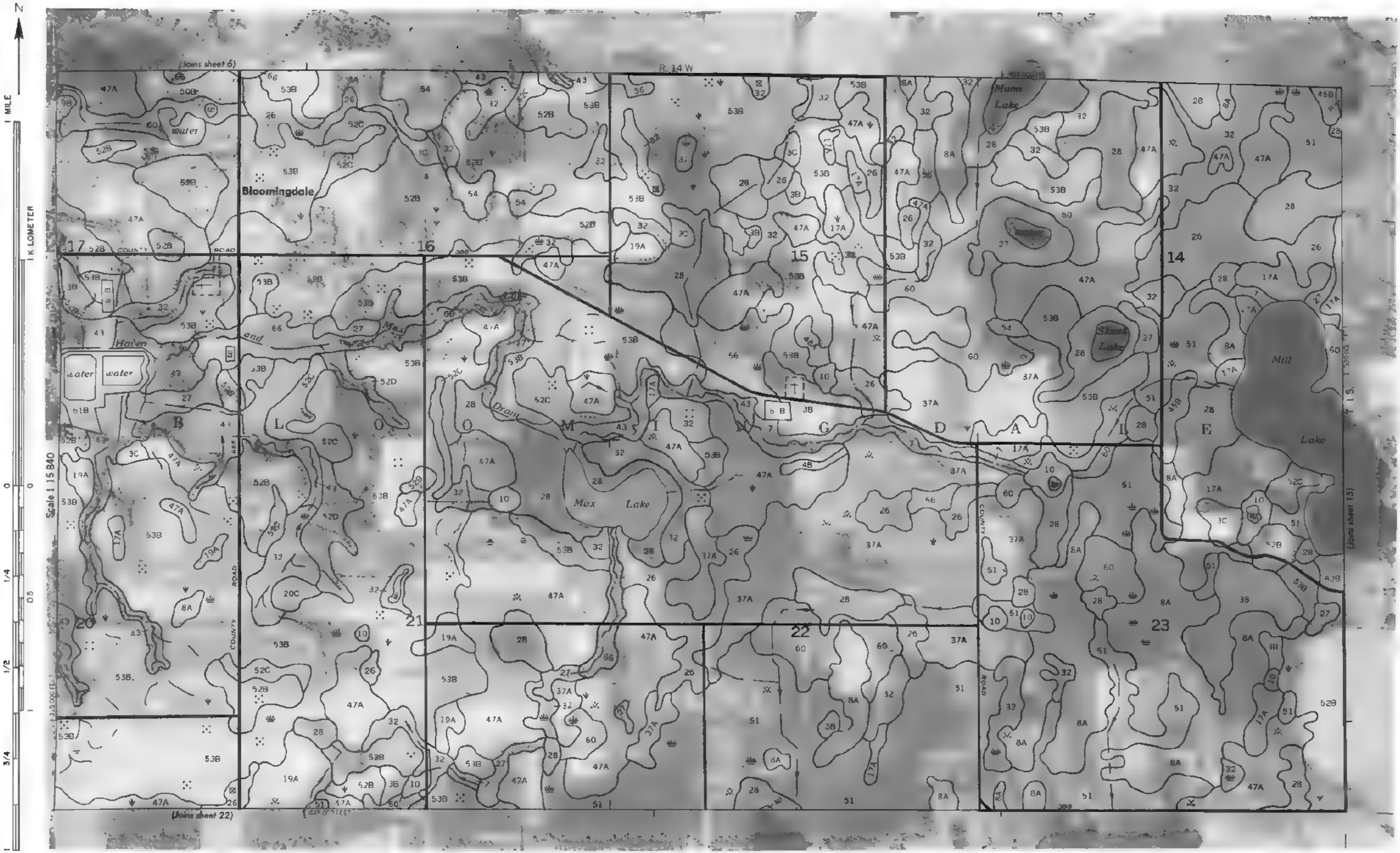
(12)

SOIL MAP OF VAN BUREN COUNTY MICHIGAN — SHEET NUMBER 12



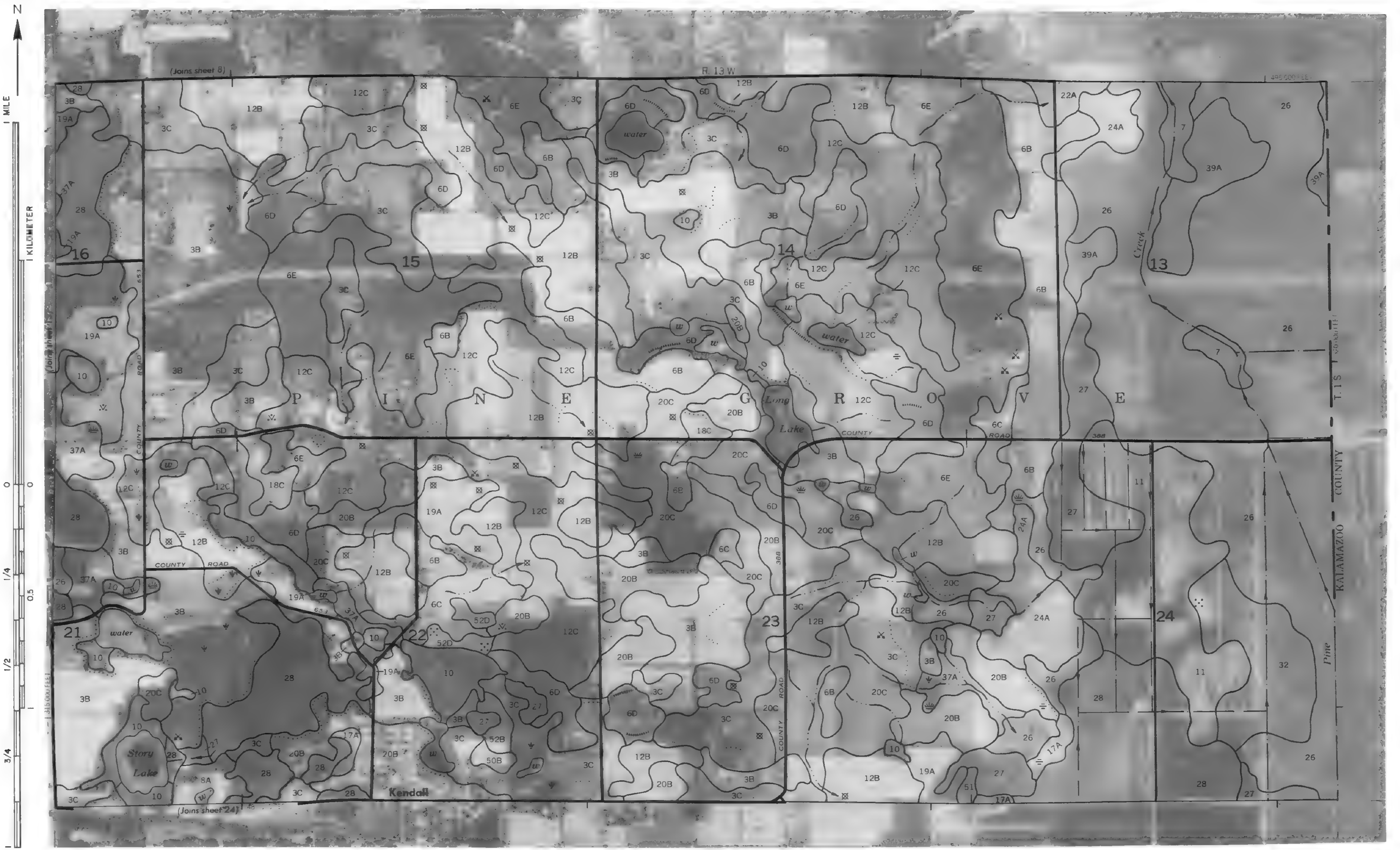

13
N
(Joins sheet 5)
(Joins sheet 21)
(Joins sheet 12)
R. 15 W.
R. 14 W.
Lake Fourteen
Great Bear Lake
C O L U M B I A
B L O O M I N G D A L E
COUNTY ROAD
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 14

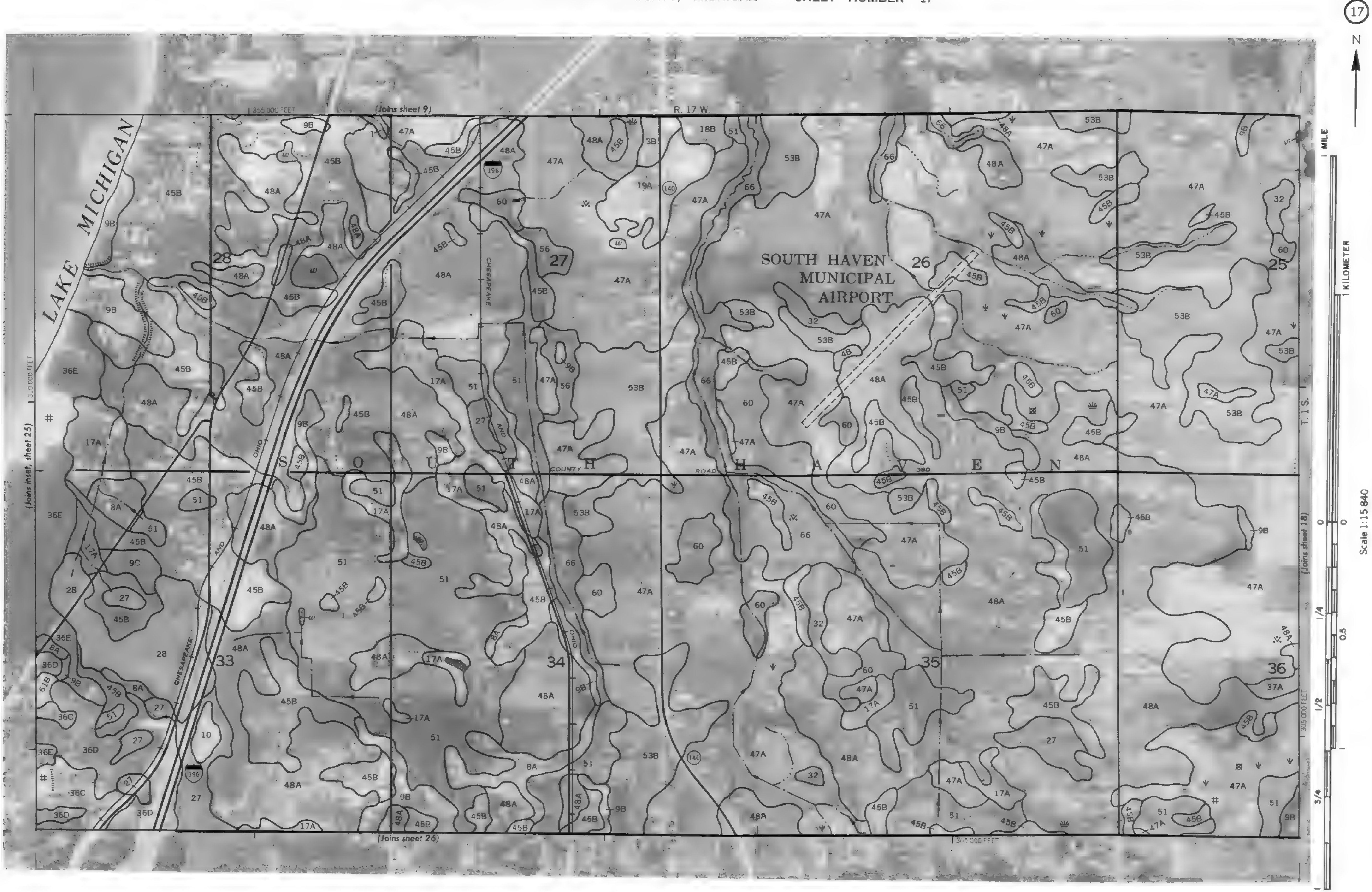


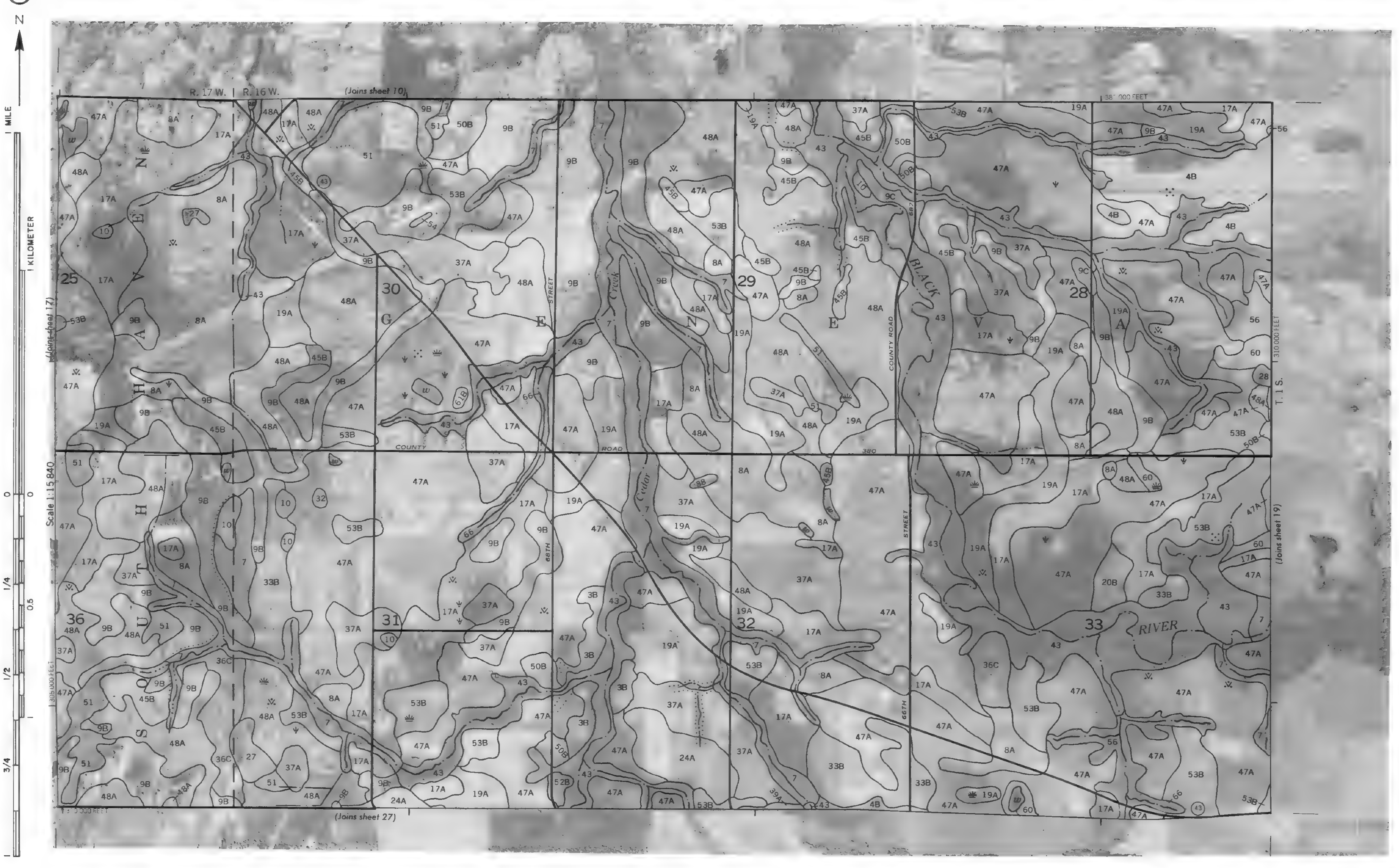

R. 14 W. | R. 13 W.
(Joins sheet 7)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 23)
T. 1 S.
BLOOMINGDALE
PINE GROVE
Mill Lake
Muskrat Lake
water
Gobles
13
18
17
16
24
19
20
21
N
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 16

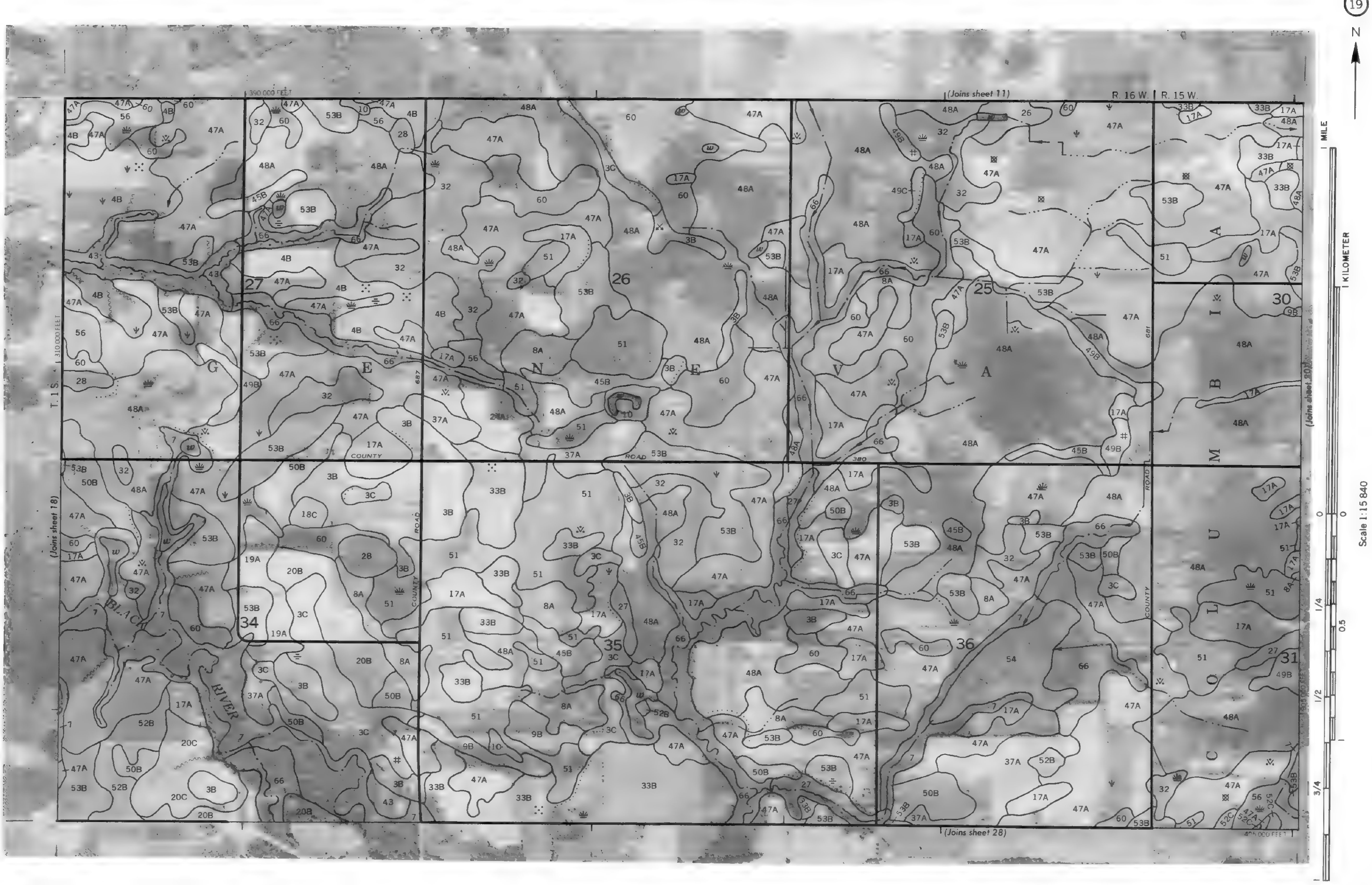


SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 17

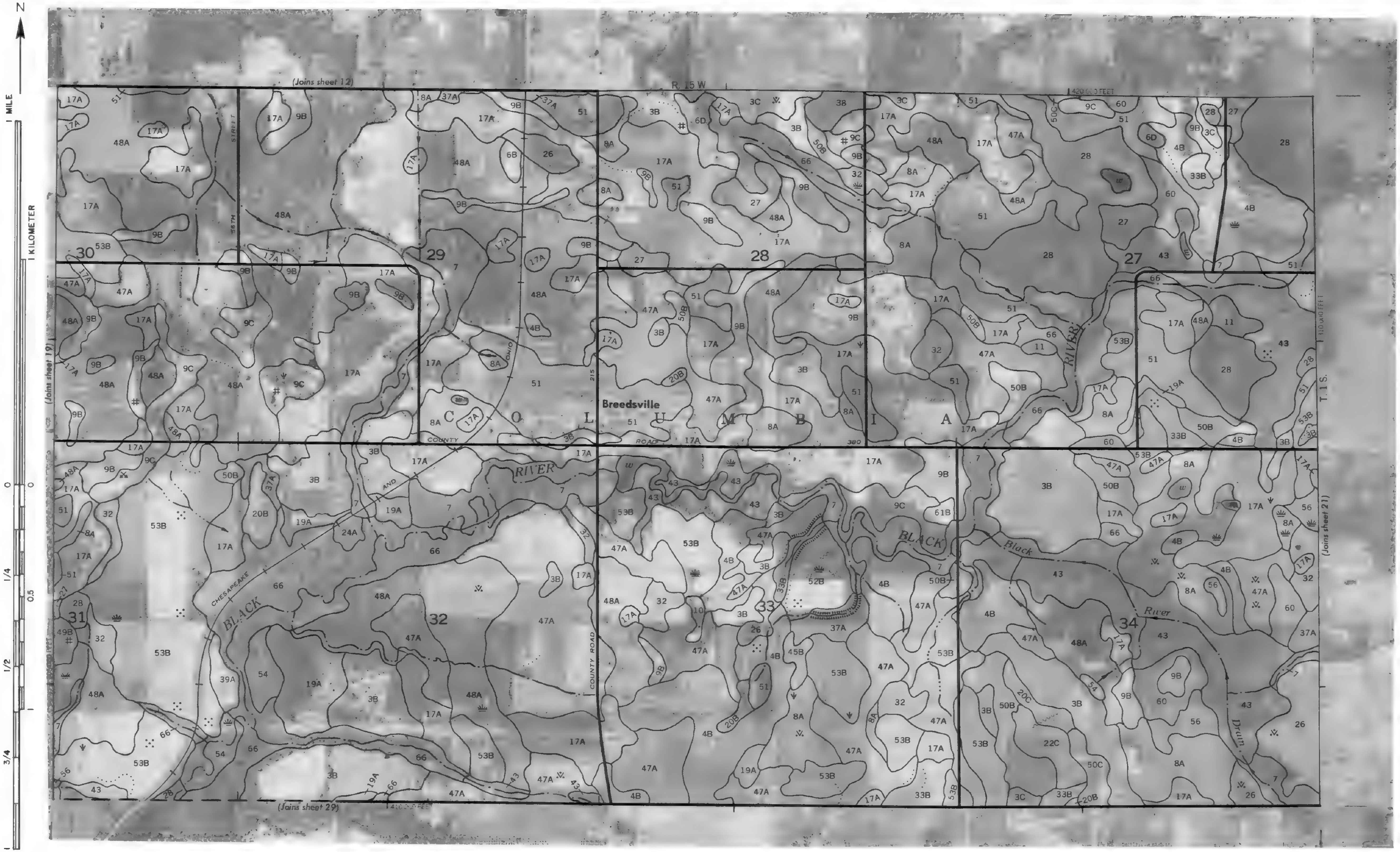


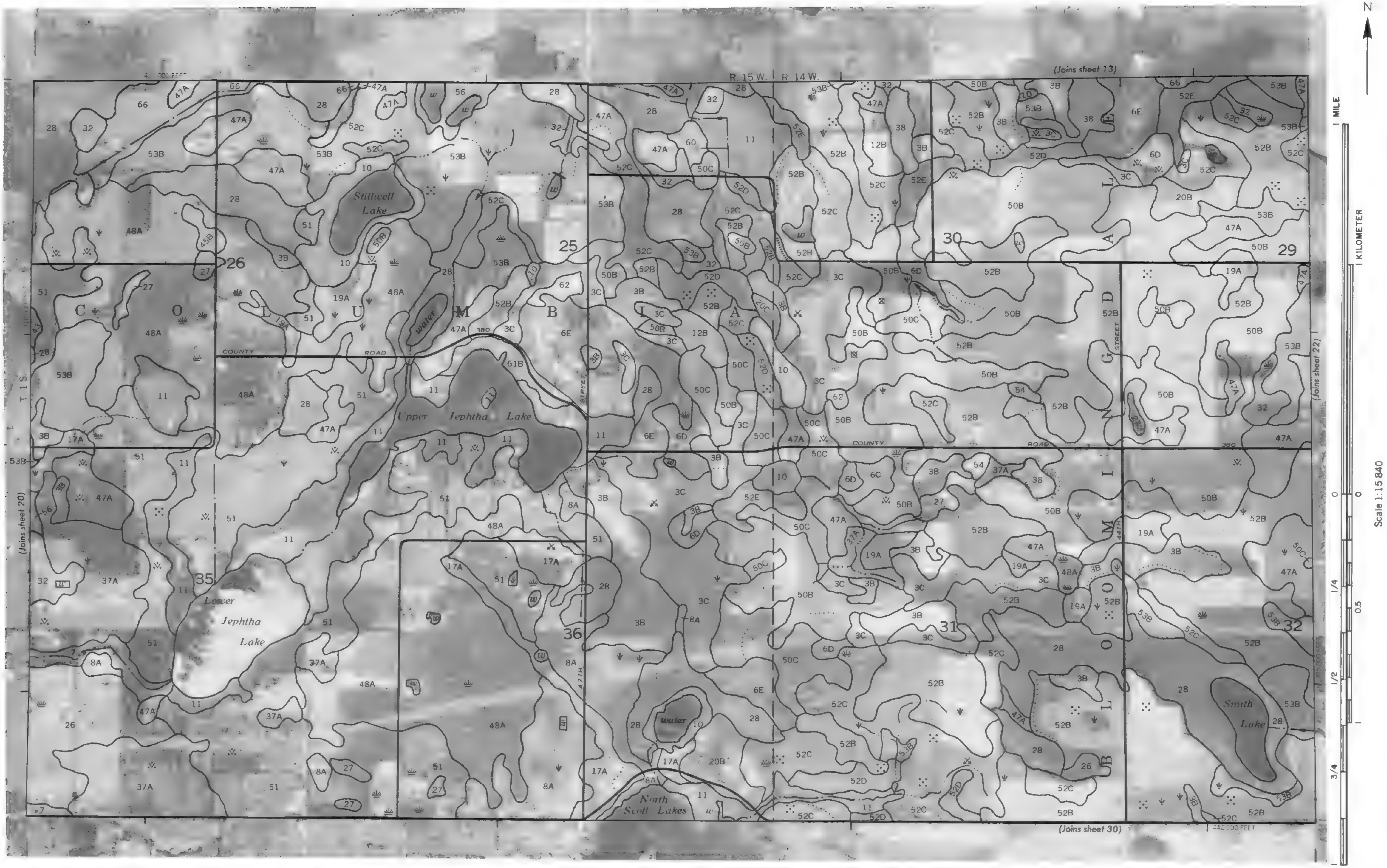

18
N
R. 17 W.
R. 16 W.
(Joins sheet 10)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 27)
T. 1 S.
Scale 1:15 840
1 MILE
1 KILOMETER
COUNTY ROAD
68TH STREET
66TH STREET
BLACK RIVER
Cedar Creek
GENEVA
SOUTH HAVEN

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 19

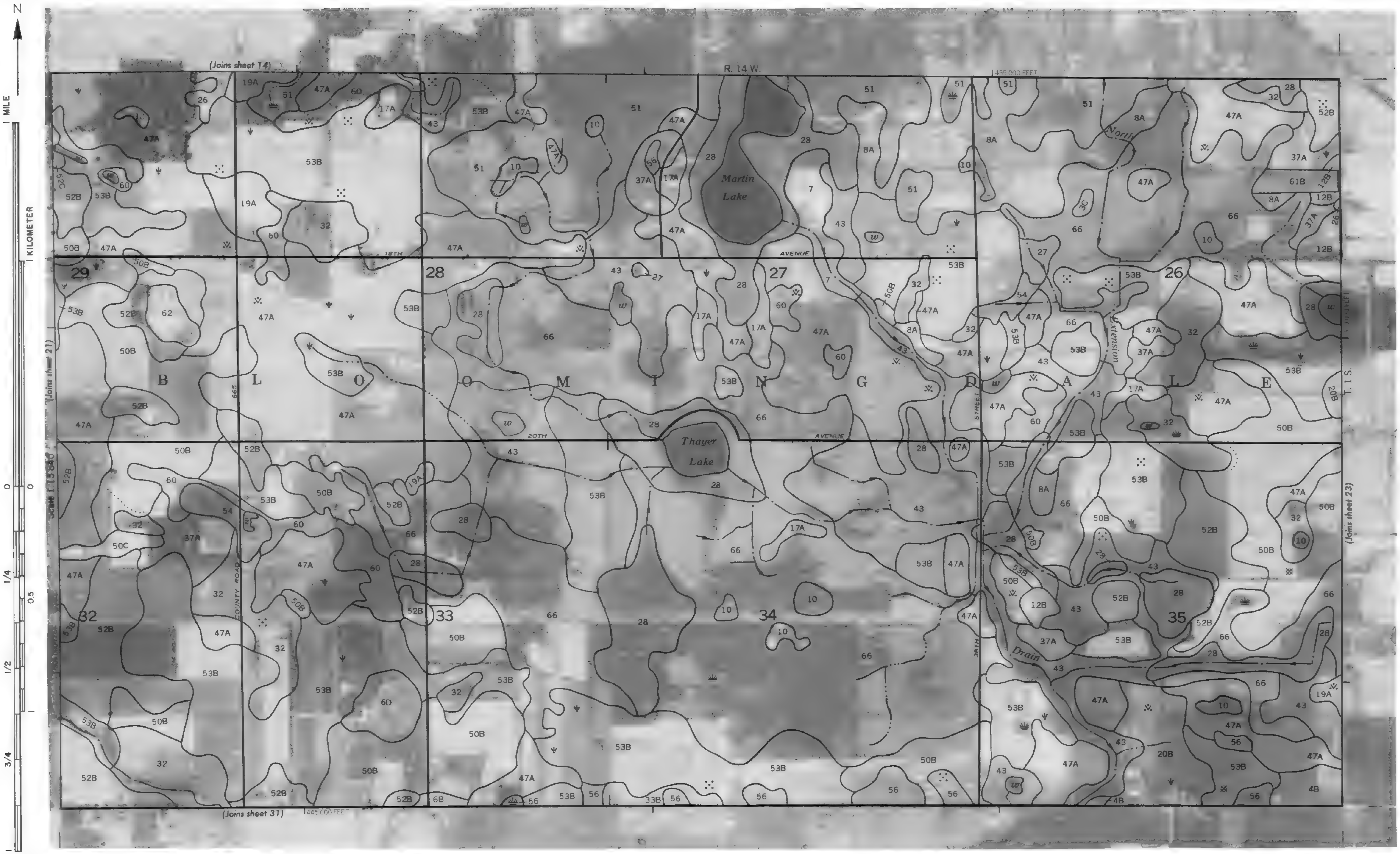


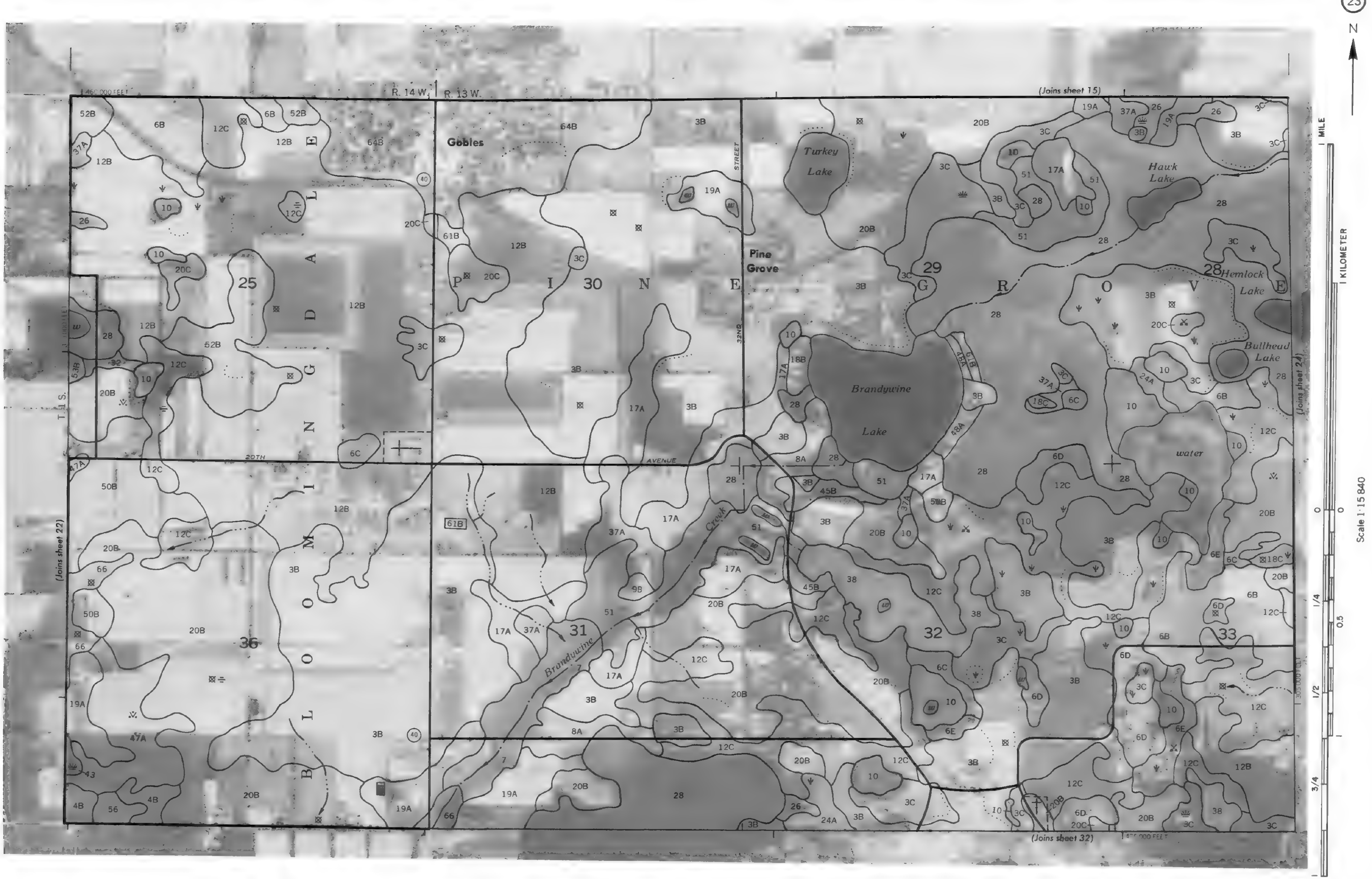
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 20

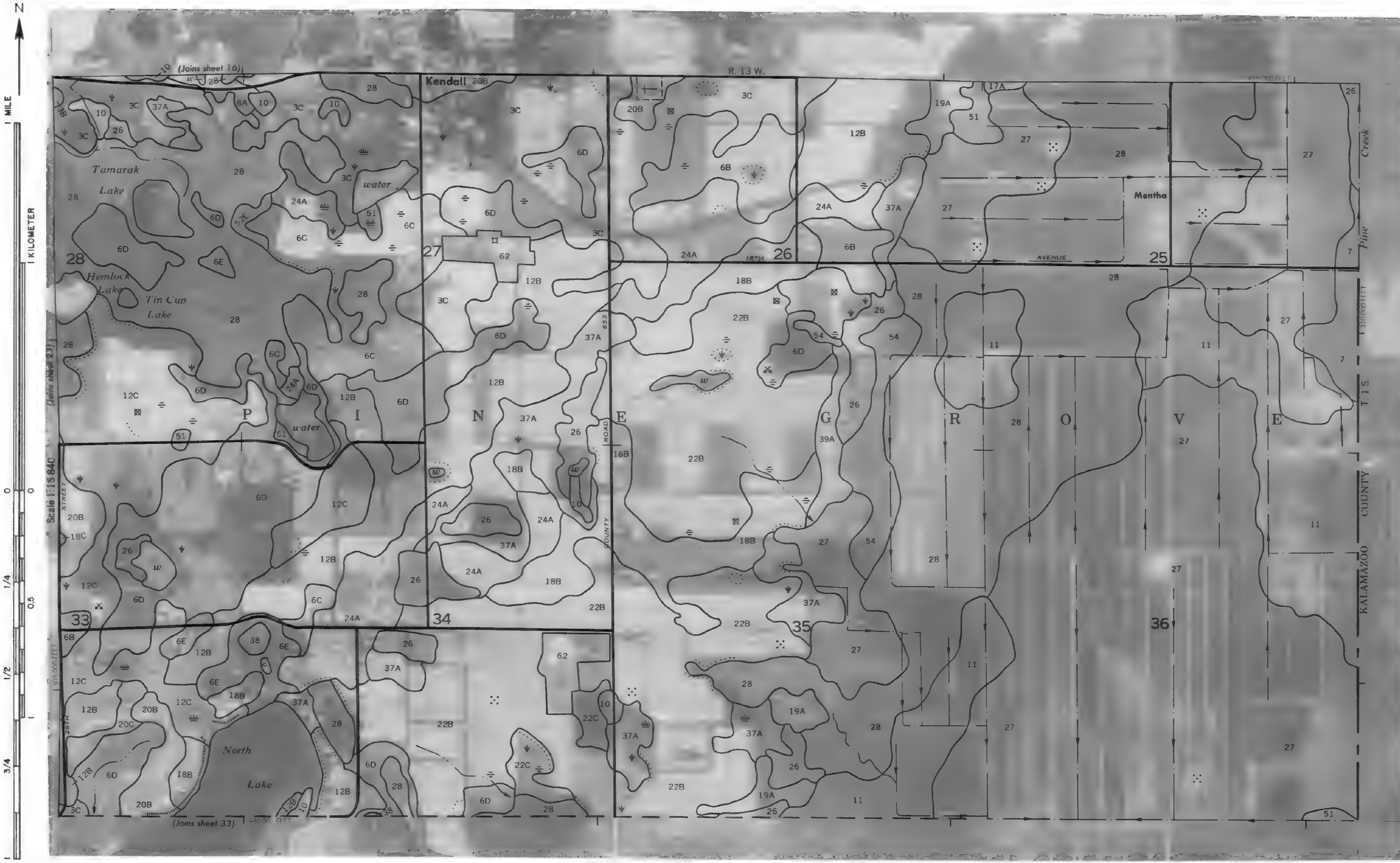


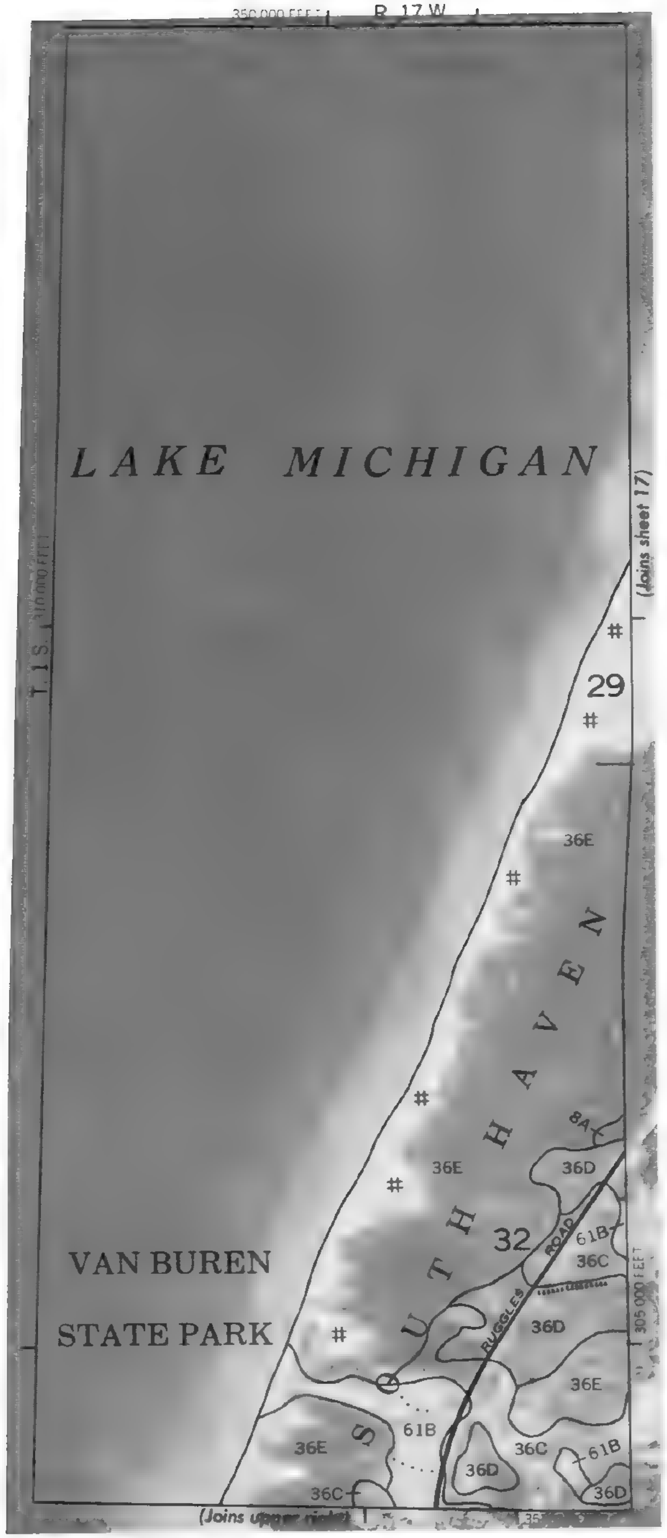

N
(Joins sheet 13)
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 30)
R. 15 W.
R. 14 W.
T. 1 S.
Stillwell Lake
Upper Jephtha Lake
Lower Jephtha Lake
North Scott Lakes
Smith Lake
water
COUNTY ROAD 380
47TH STREET
44TH STREET
COLUMBIA
BLOOMINGDALE
25
26
29
30
31
32
35
36
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 22

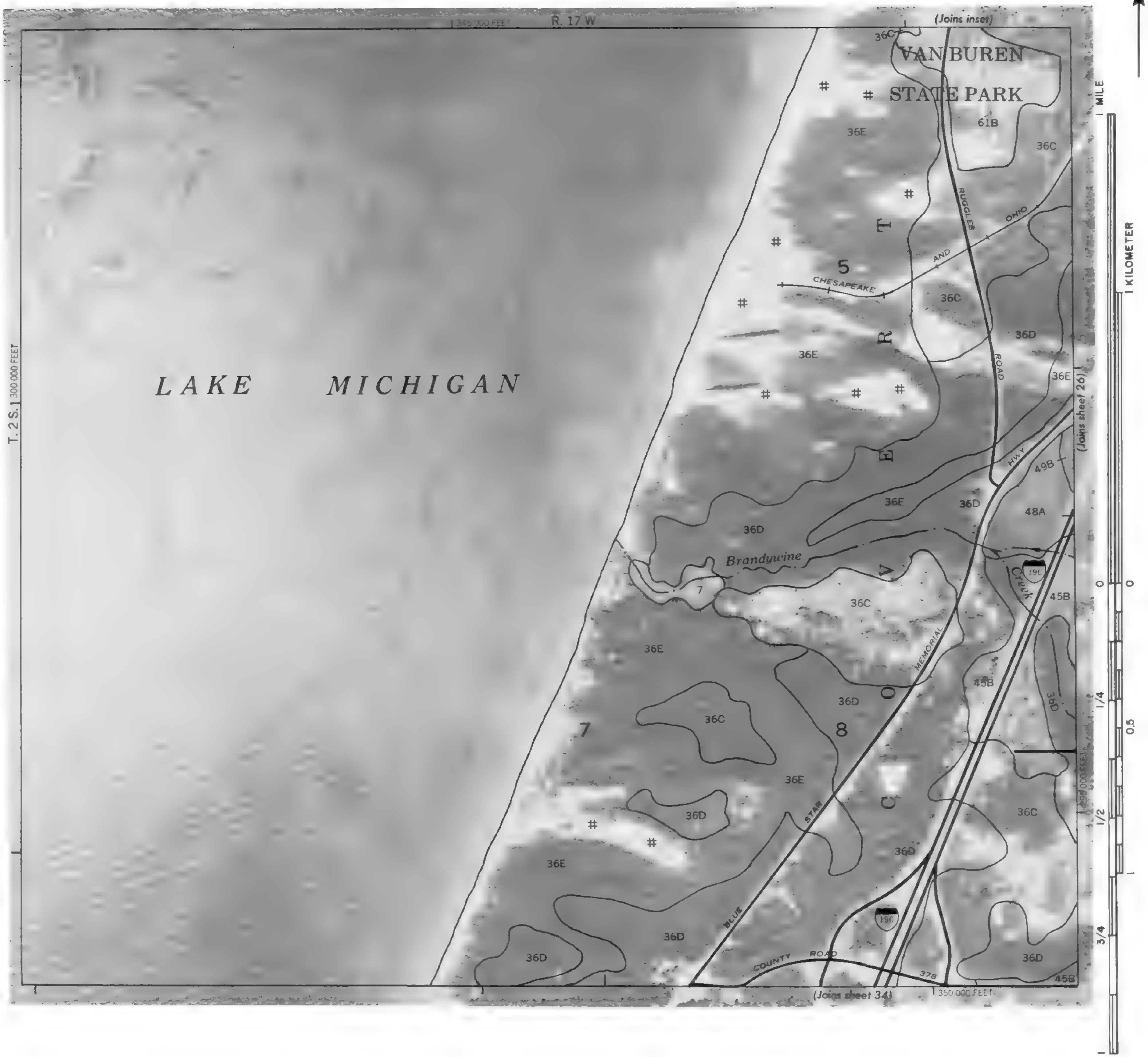


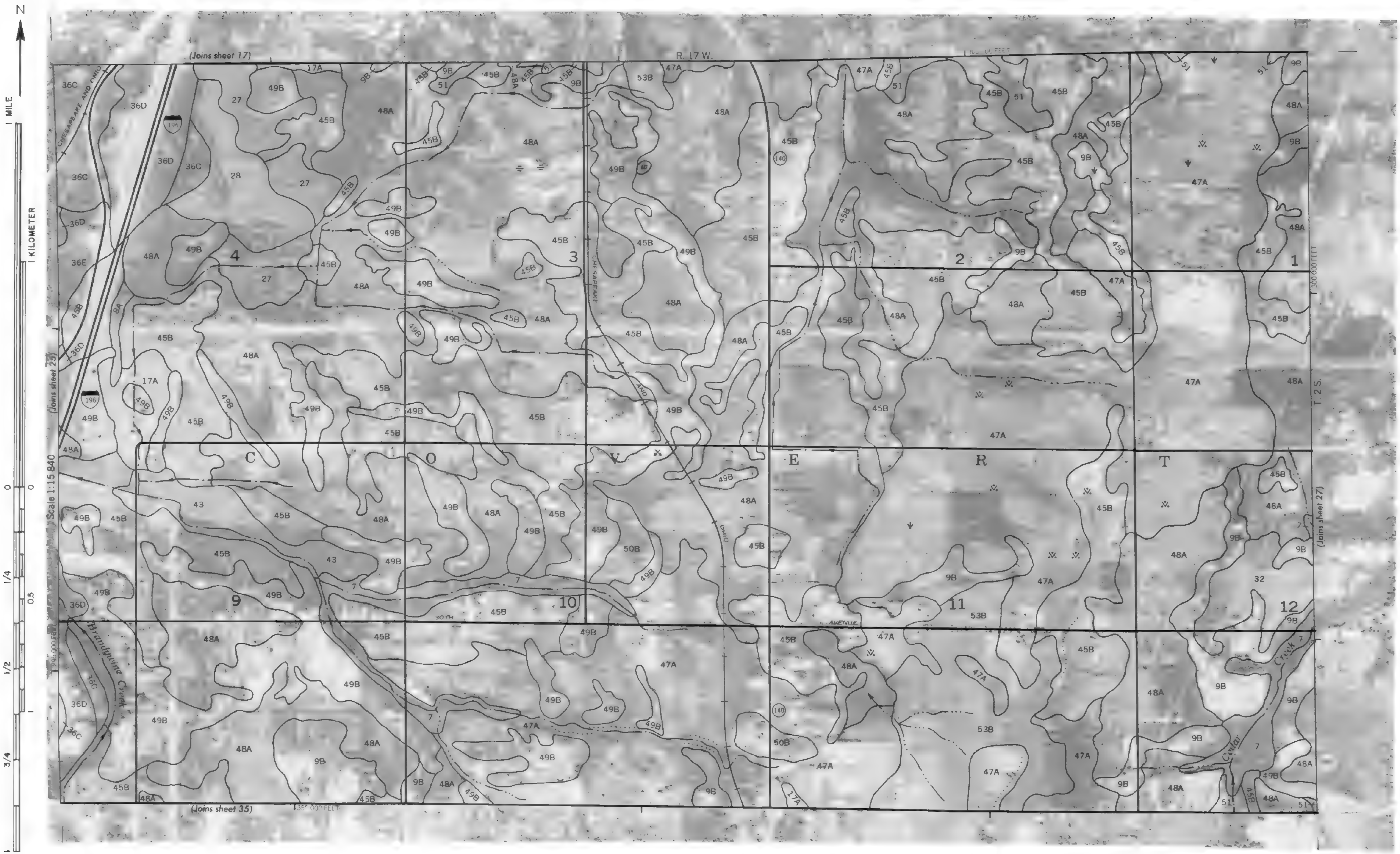

23
N
R. 14 W.
R. 13 W.
(Joins sheet 15)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 32)
T. 1 S.
Gobles
Pine Grove
Turkey Lake
Hawk Lake
Hemlock Lake
Bullhead Lake
Brandywine Lake
Brandywine Creek
water
20TH AVENUE
32ND STREET
BLOOMINGDALE
PINE GROVE
25
30
29
28
36
31
32
33
1 MILE
1 KILOMETER
Scale 1:15 840

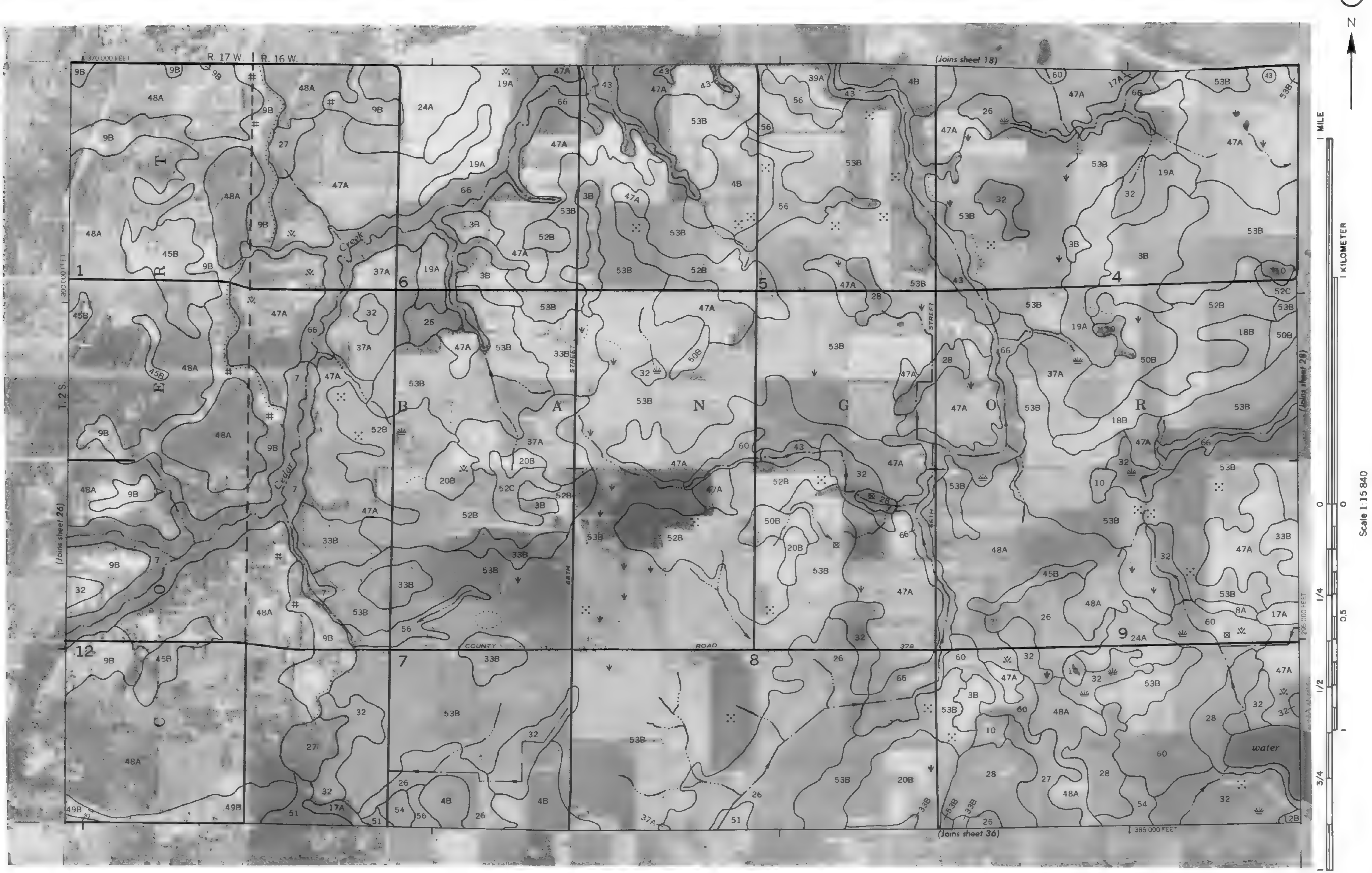

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 16)
R. 13 W.
Kendall
Tamarak Lake
Hemlock Lake
Tin Cup Lake
water
North Lake
Mentha
AVENUE
COUNTY ROAD 653
P I N E G R O V E
Pine Creek
KALAMAZOO COUNTY
T. 1 S.
28
27
26
25
33
34
35
36
(Joins sheet 33)

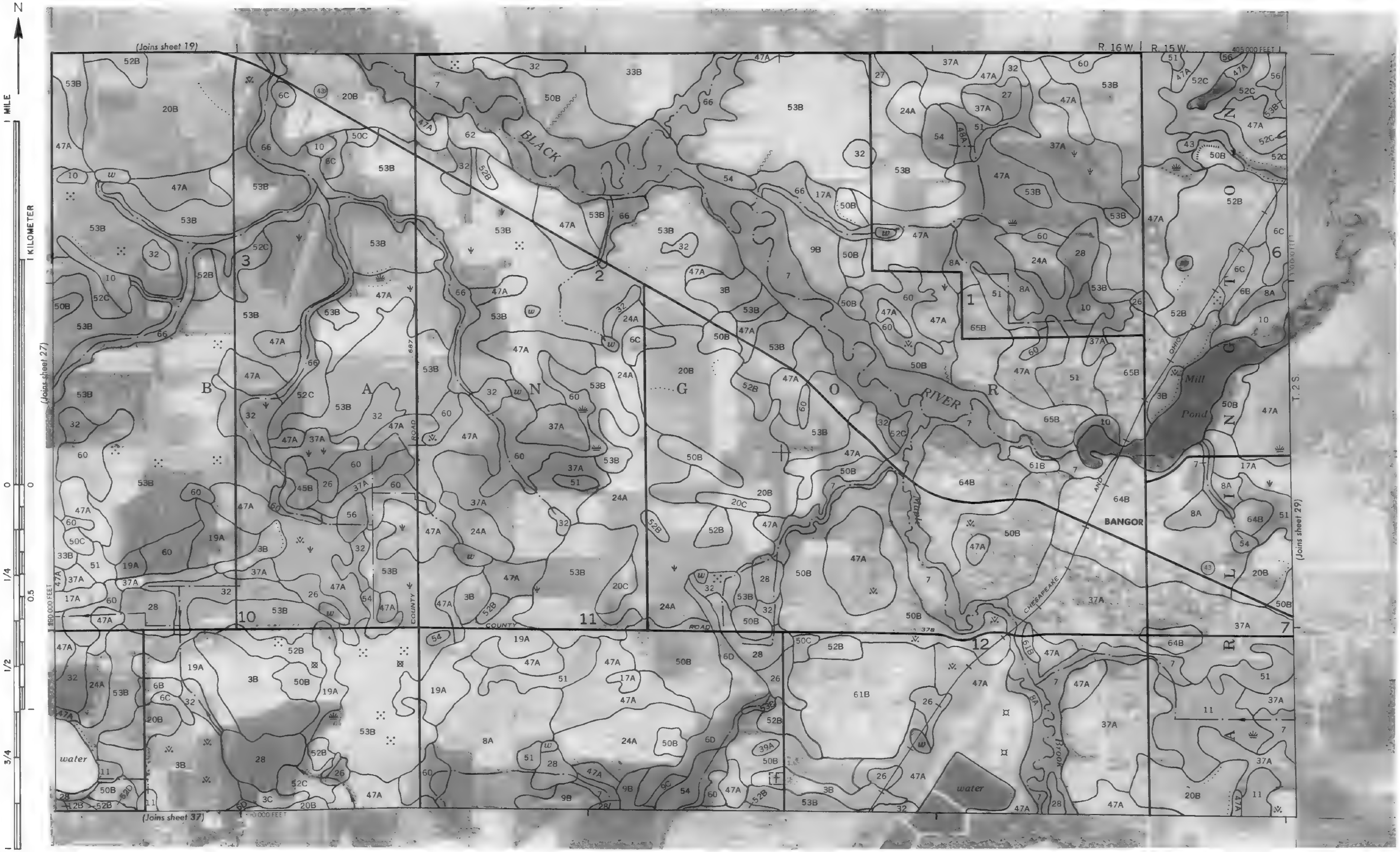


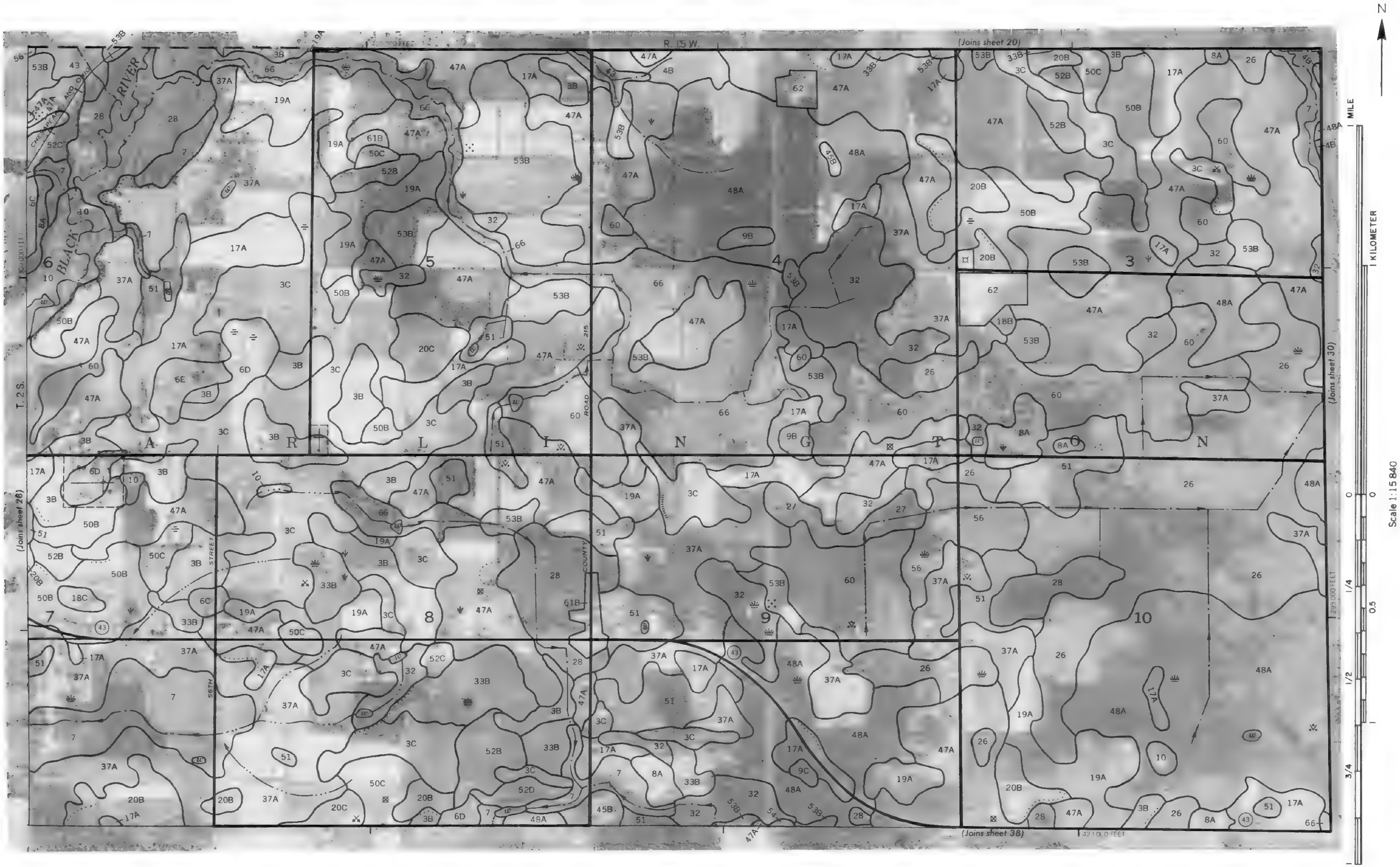
1000 AND 5000-FOOT GRID TICKS

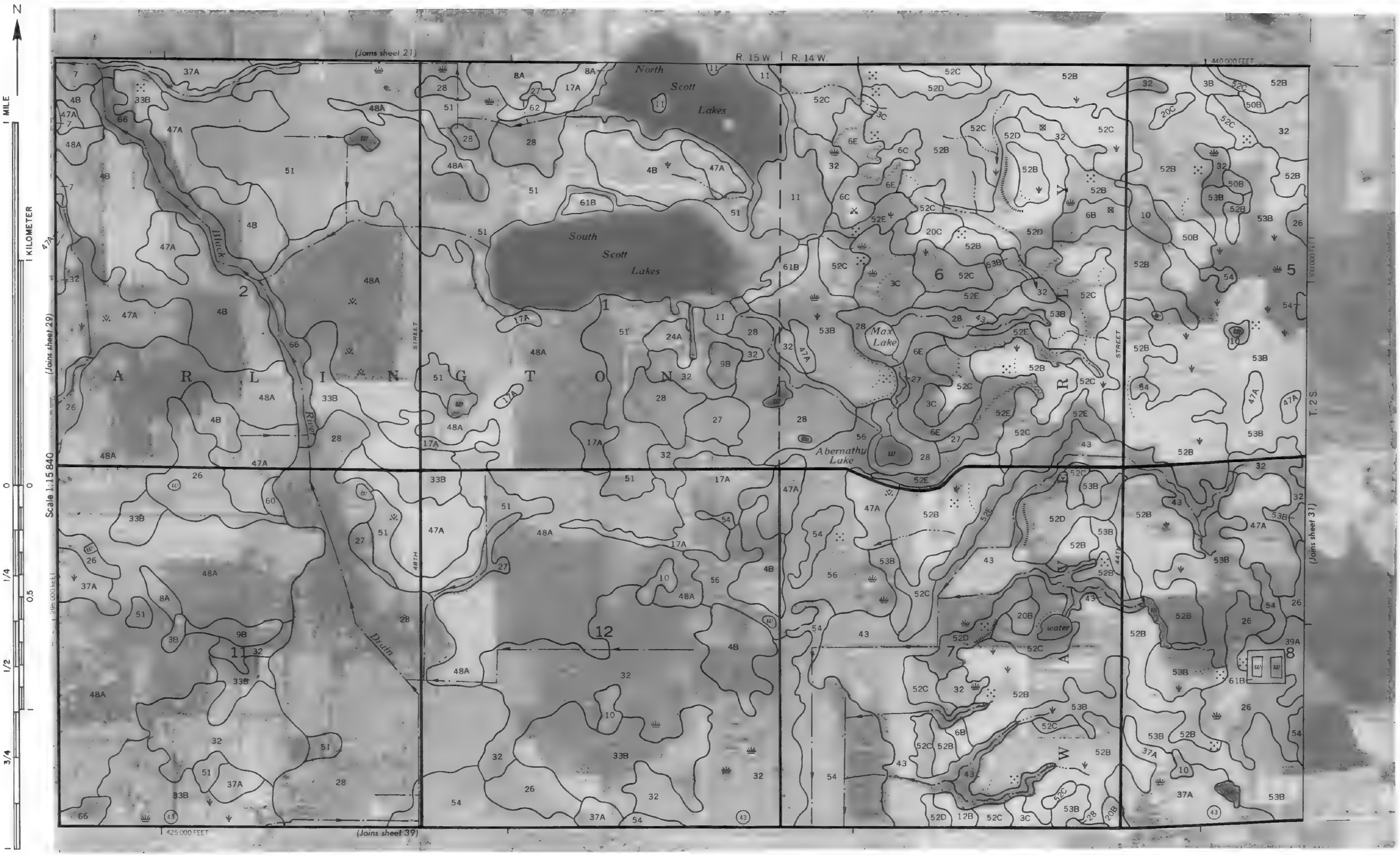


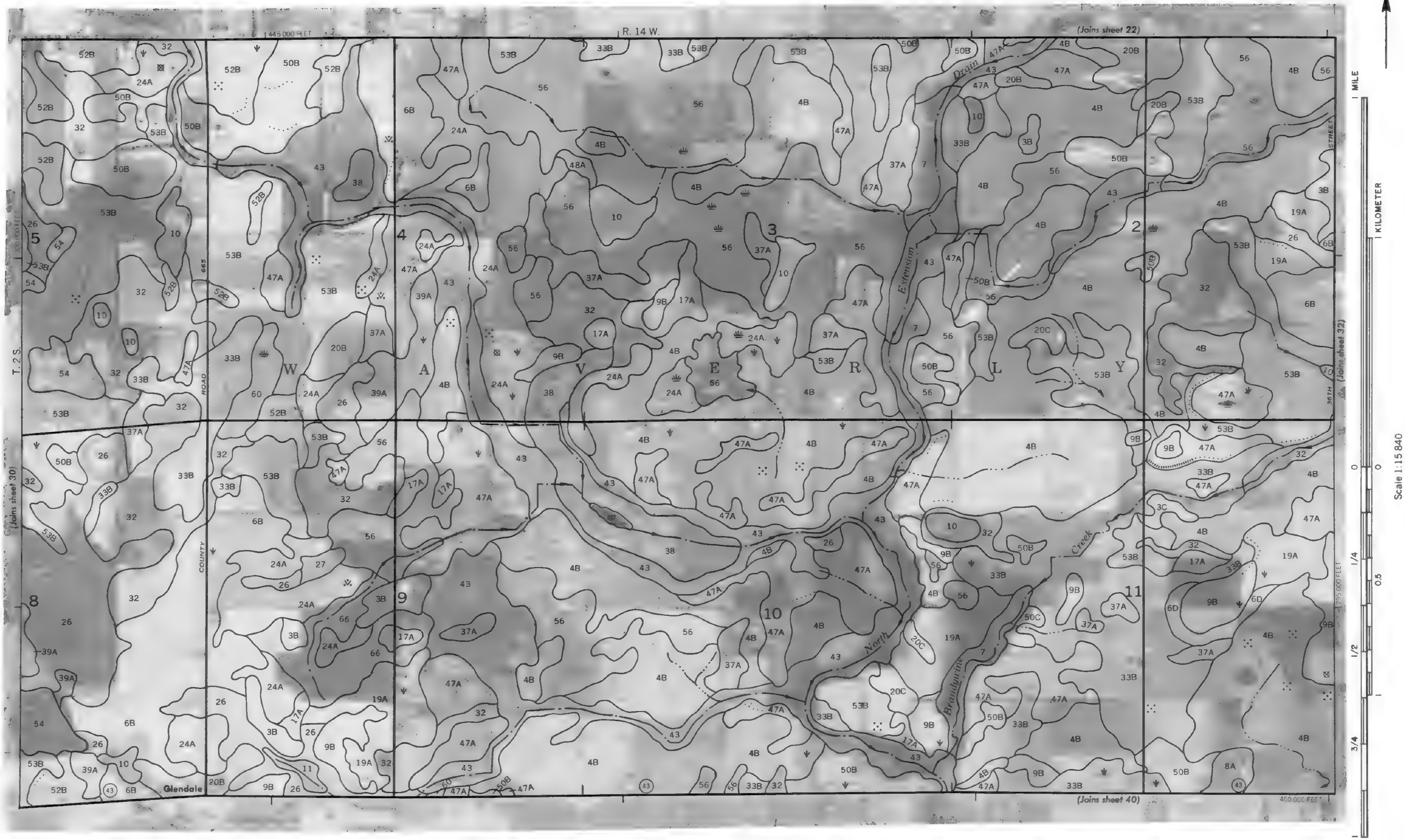

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 17)
(Joins sheet 25)
(Joins sheet 27)
(Joins sheet 35)
R. 17 W.
T. 2 S.
300 000 FEET
CHESAPEAKE AND OHIO
196
140
C O V E R T
4
3
2
1
9
10
11
12
30TH AVENUE
Brandywine Creek
Cedar Creek

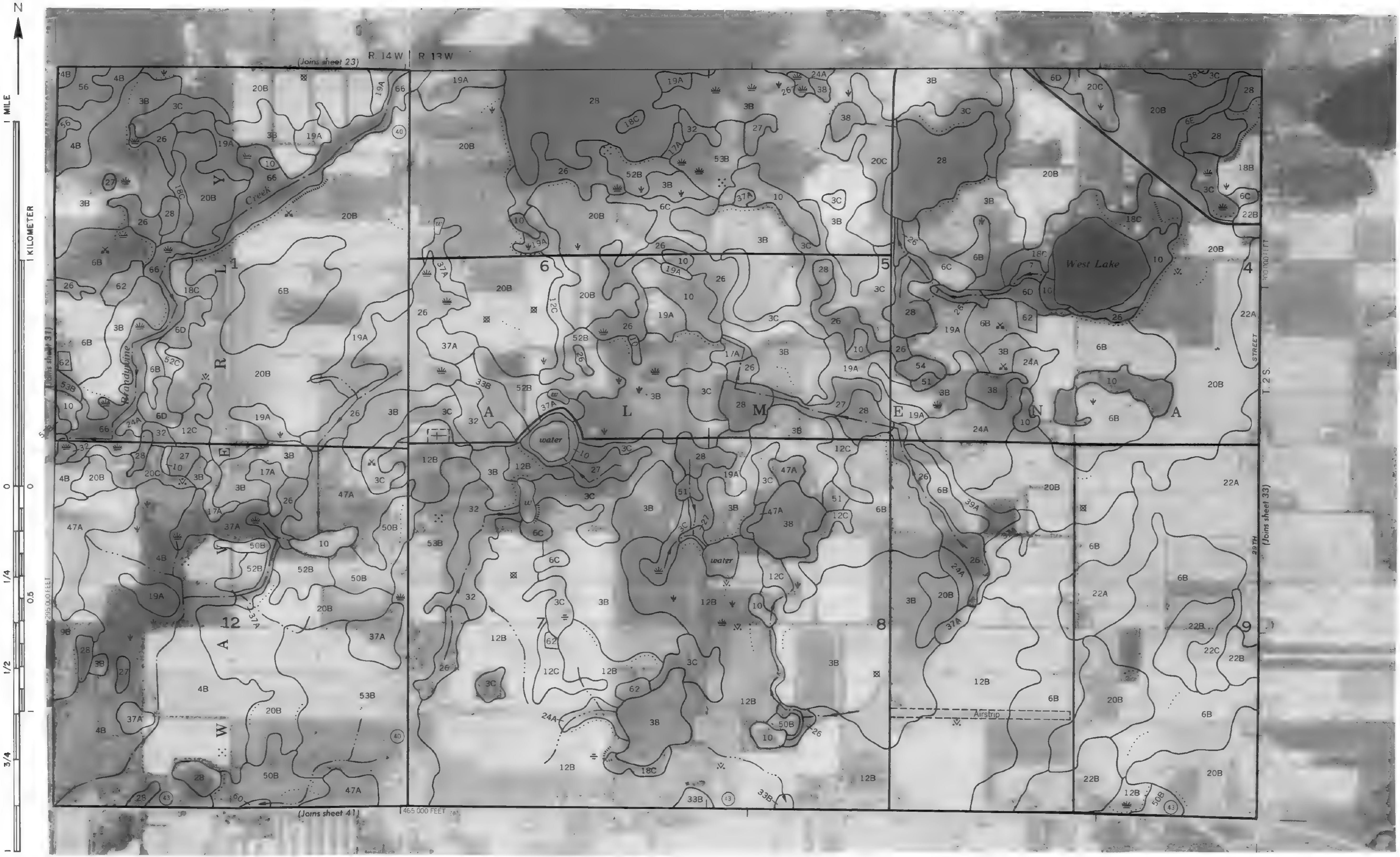

N
370 000 FEET
R. 17 W.
R. 16 W.
(Joins sheet 18)
(Joins sheet 28)
(Joins sheet 36)
(Joins sheet 26)
T. 2 S.
200 000 FEET
295 000 FEET
385 000 FEET
Cedar
Creek
68TH STREET
66TH STREET
COUNTY ROAD 378
water
BANGOR
ARCOCEM
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840

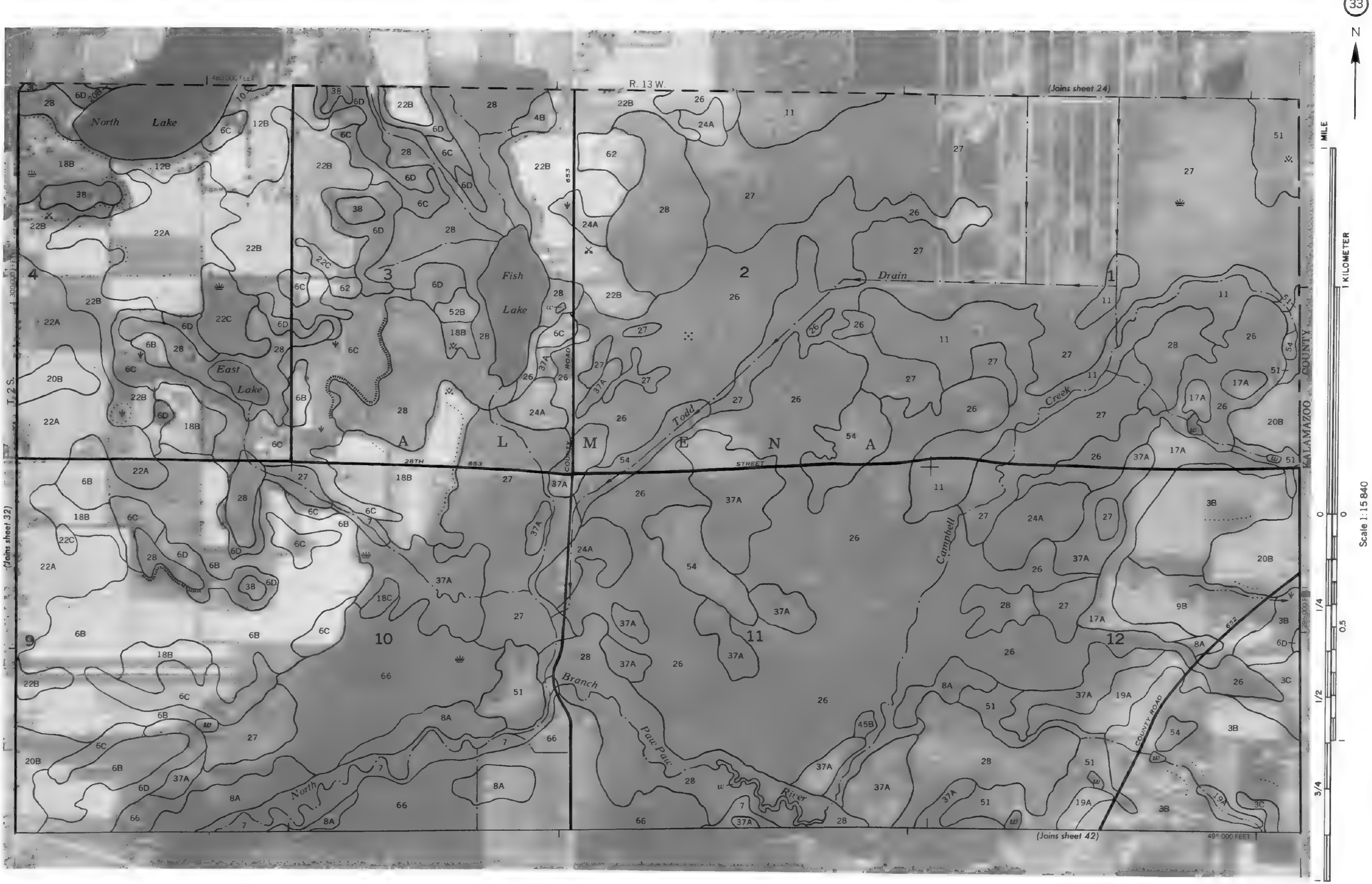

N
1 MILE
1 KILOMETER
(Joins sheet 19)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 37)
R. 16 W.
R. 15 W.
T. 2 S.
BLACK RIVER
Mill Pond
BANGOR
CHESAPEAKE AND OHIO
COUNTY ROAD
B A N G O R
L I N C O L N
water


N
R. 15 W.
(Joins sheet 20)
(Joins sheet 30)
(Joins sheet 38)
(Joins sheet 28)
T. 2 S.
BLACK RIVER
CHESAPEAKE AND OHIO
A R L I N G T O N
COUNTY ROAD 215
56TH STREET
1 MILE
1 KILOMETER
Scale 1:15 840

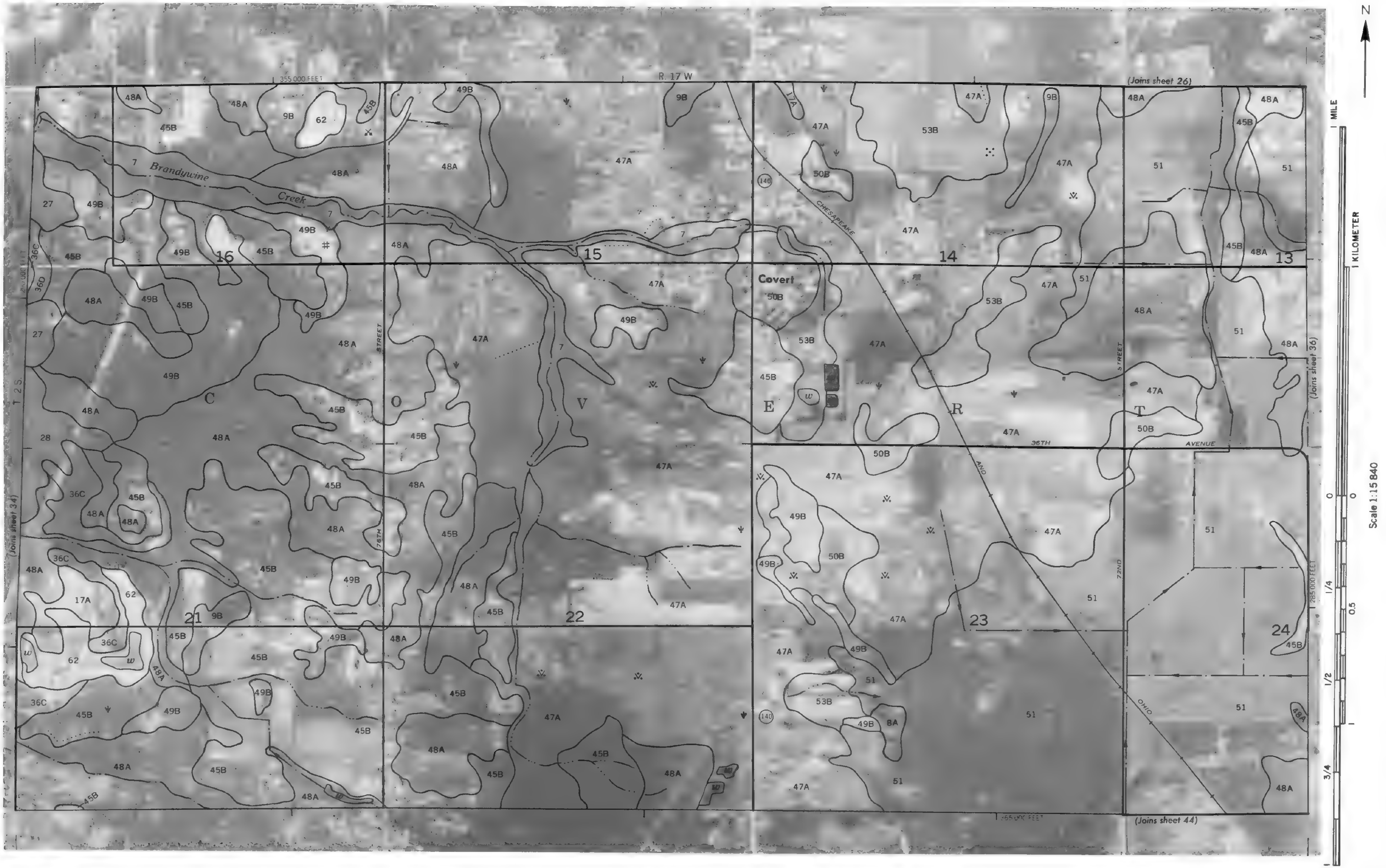

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 21)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 39)
R. 15 W.
R. 14 W.
T. 2 S.
440 000 FEET
425 000 FEET
North Scott Lakes
South Scott Lakes
Max Lake
Abernathy Lake
Black River
Drain
ARLINGTON
48TH STREET
44TH STREET
STREET
water


R. 14 W.
(Joins sheet 22)
(Joins sheet 40)
(Joins sheet 30)
(Joins sheet 32)
T. 2 S.
445 000 FEET
460 000 FEET
295 000 FEET
W A V E R L Y
Drain Extension
North Branch
Brandywine Creek
COUNTY ROAD 665
36TH STREET
Glendale
N
1 MILE
1 KILOMETER
Scale 1:15 840


N
MILE
KILOMETER
(Joins sheet 23)
R 14 W
R 13 W
Creek
Brandywine
West Lake
water
Airstrip
WAVERLY
ALMENA
T. 2 S.
29TH STREET
(Joins sheet 33)
(Joins sheet 31)
(Joins sheet 41)
465 000 FEET
295 000 FEET

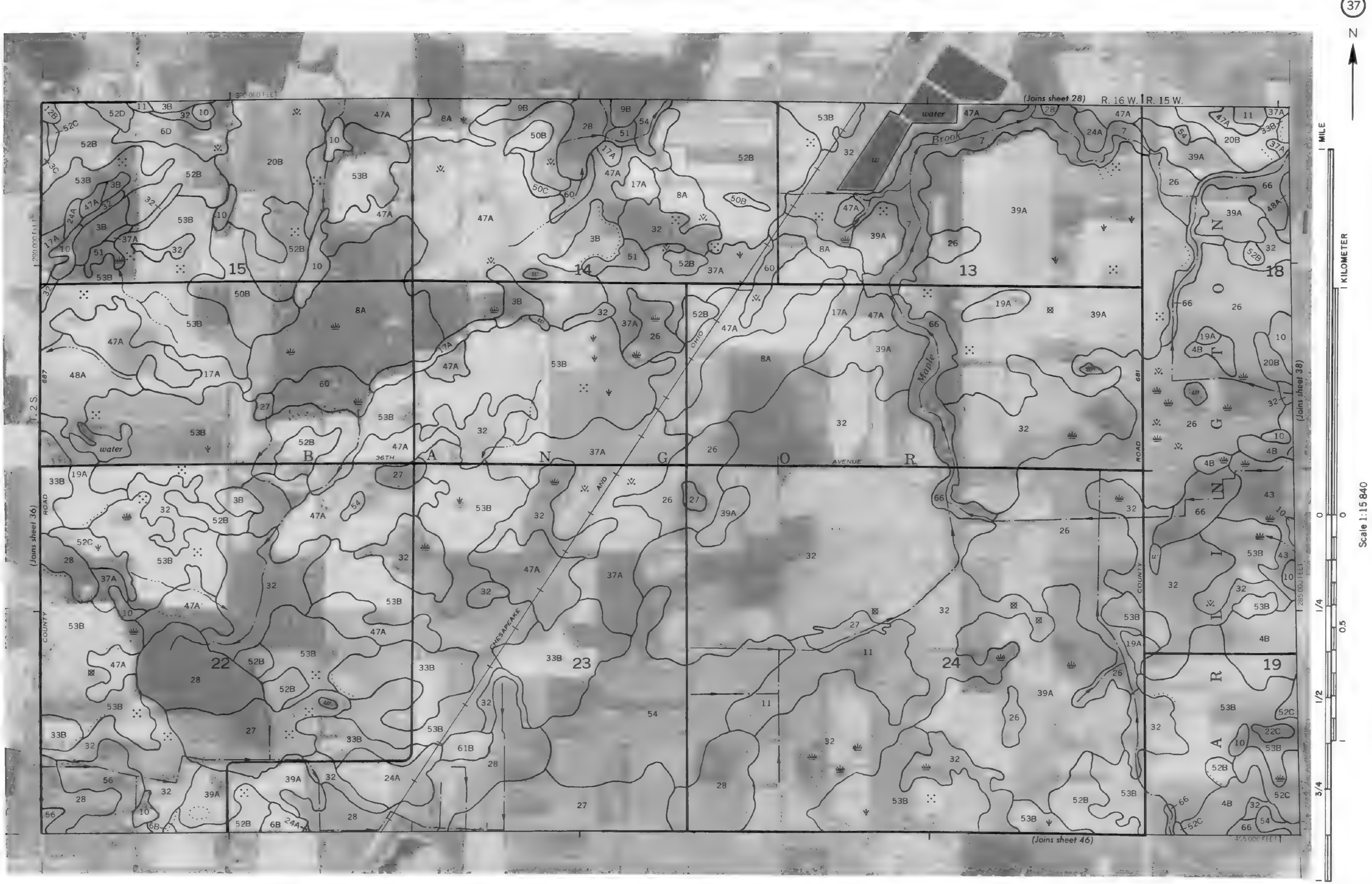

33
N
R. 13 W.
(Joins sheet 24)
(Joins sheet 32)
(Joins sheet 42)
T. 2 S.
North Lake
Fish Lake
East Lake
A L M E N A
28TH STREET
COUNTY ROAD
Drain
Todd
Creek
Campbell
Branch
Paw Paw River
North
KALAMAZOO COUNTY
MILE
KILOMETER
Scale 1:15 840

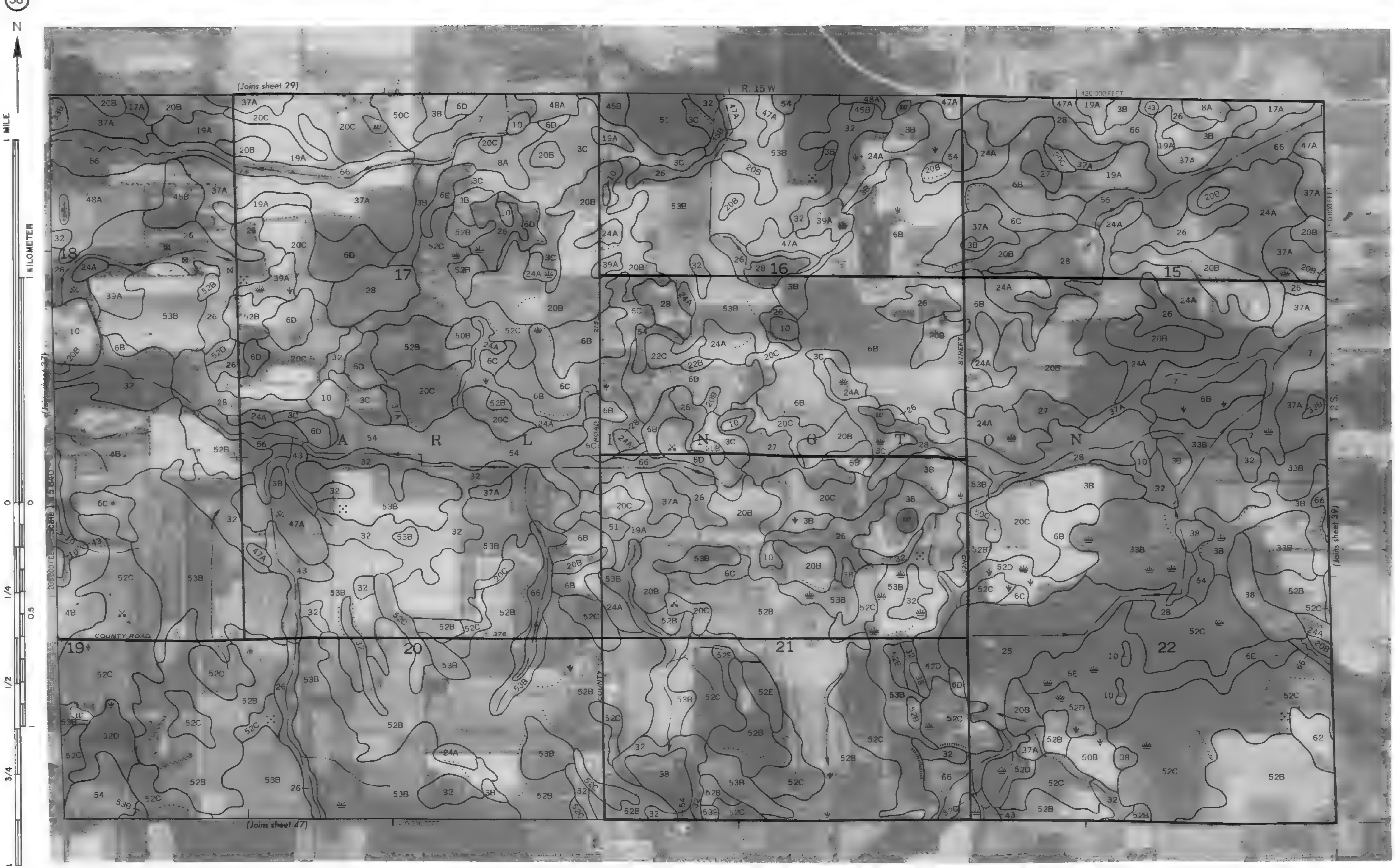

34
N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
1
(Joins sheet 25)
R. 18 W.
R. 17 W.
LAKE
MICHIGAN
COVERT
18
17
19
20
24
BLUE STAR MEMORIAL HWY.
196
Creek
Brandywine
water
T. 2 S.
(Joins sheet 35)
(Joins sheet 43)
335 000 FEET
350 000 FEET
36D
36E
36C
45B
27
28
48A
49B

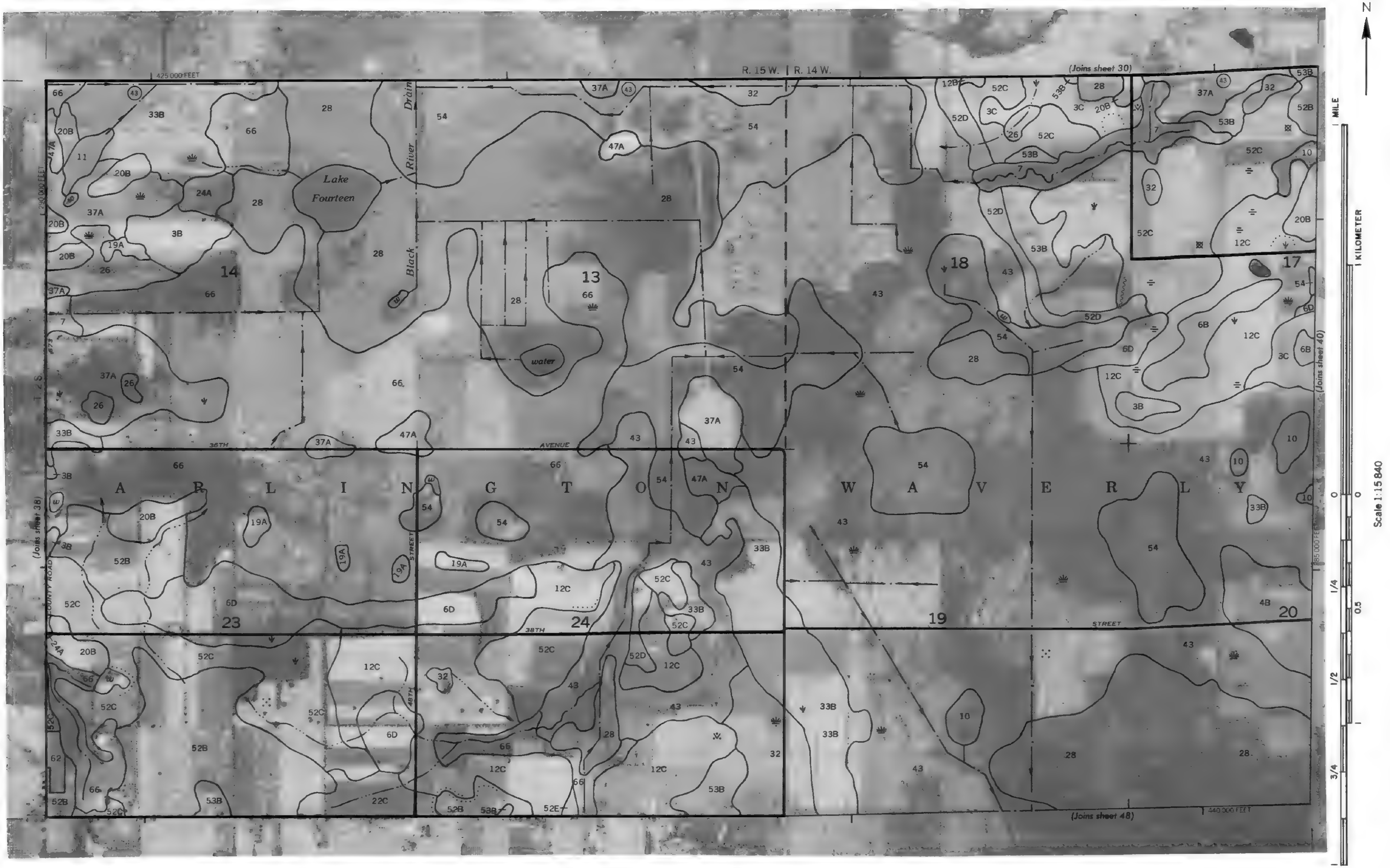

35
N
(Joins sheet 26)
(Joins sheet 44)
(Joins sheet 34)
(Joins sheet 36)
R. 17 W.
T. 2 S.
Brandywine
Creek
Covert
C O V E R T
CHESAPEAKE AND OHIO
36TH AVENUE
76TH STREET
72ND STREET
16
15
14
13
21
22
23
24
1 MILE
1 KILOMETER
Scale 1:15 840

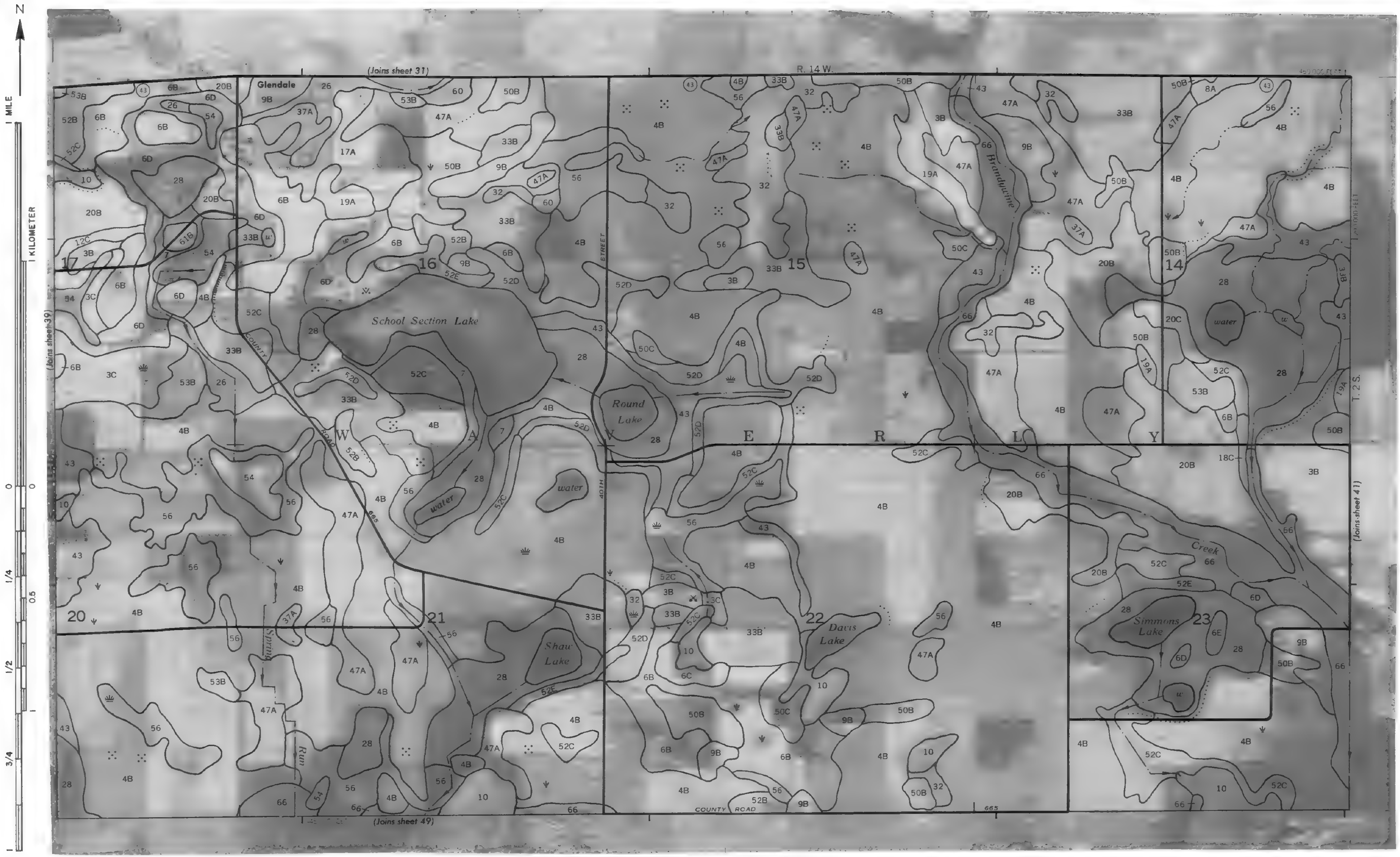
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 36

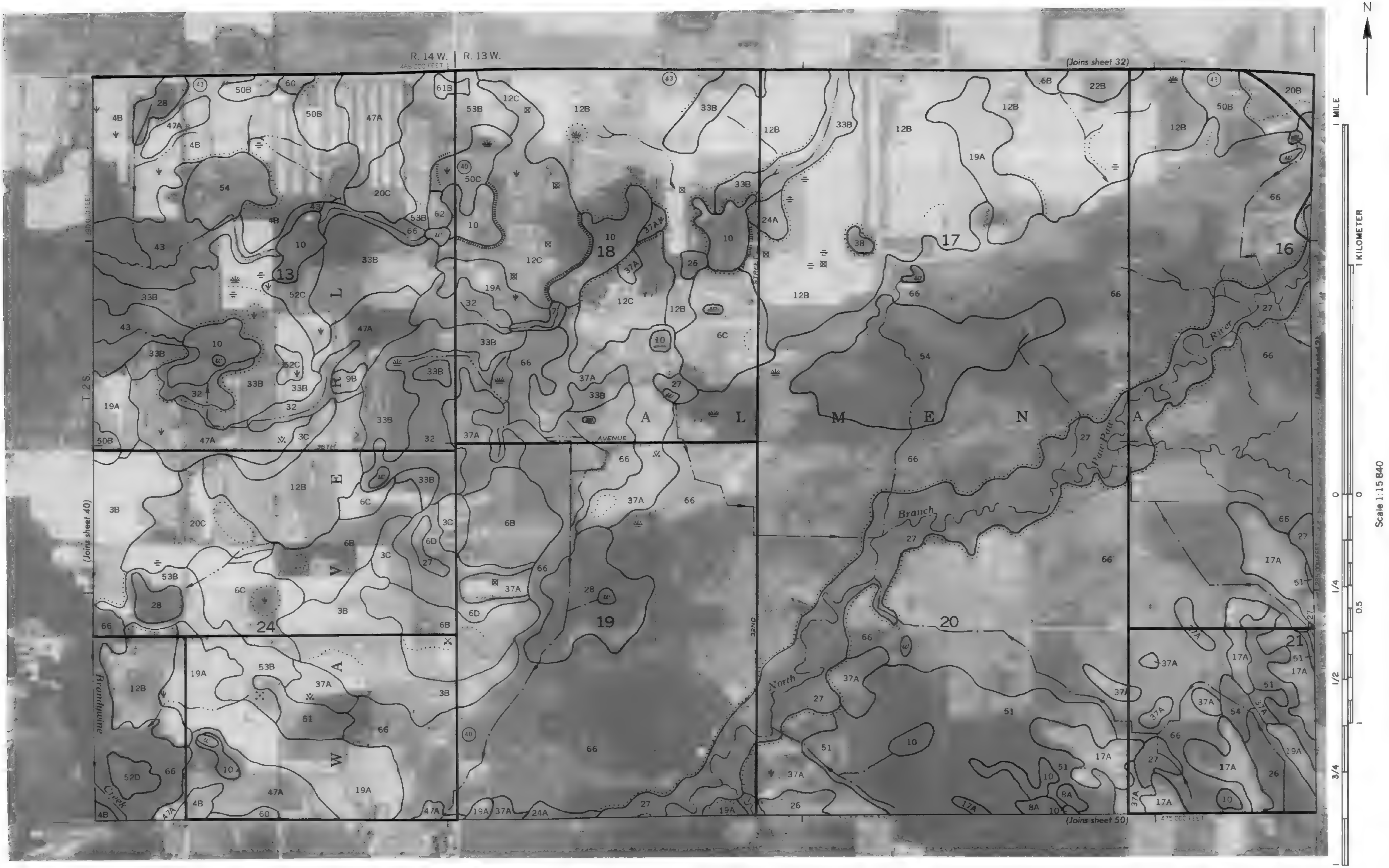
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 37

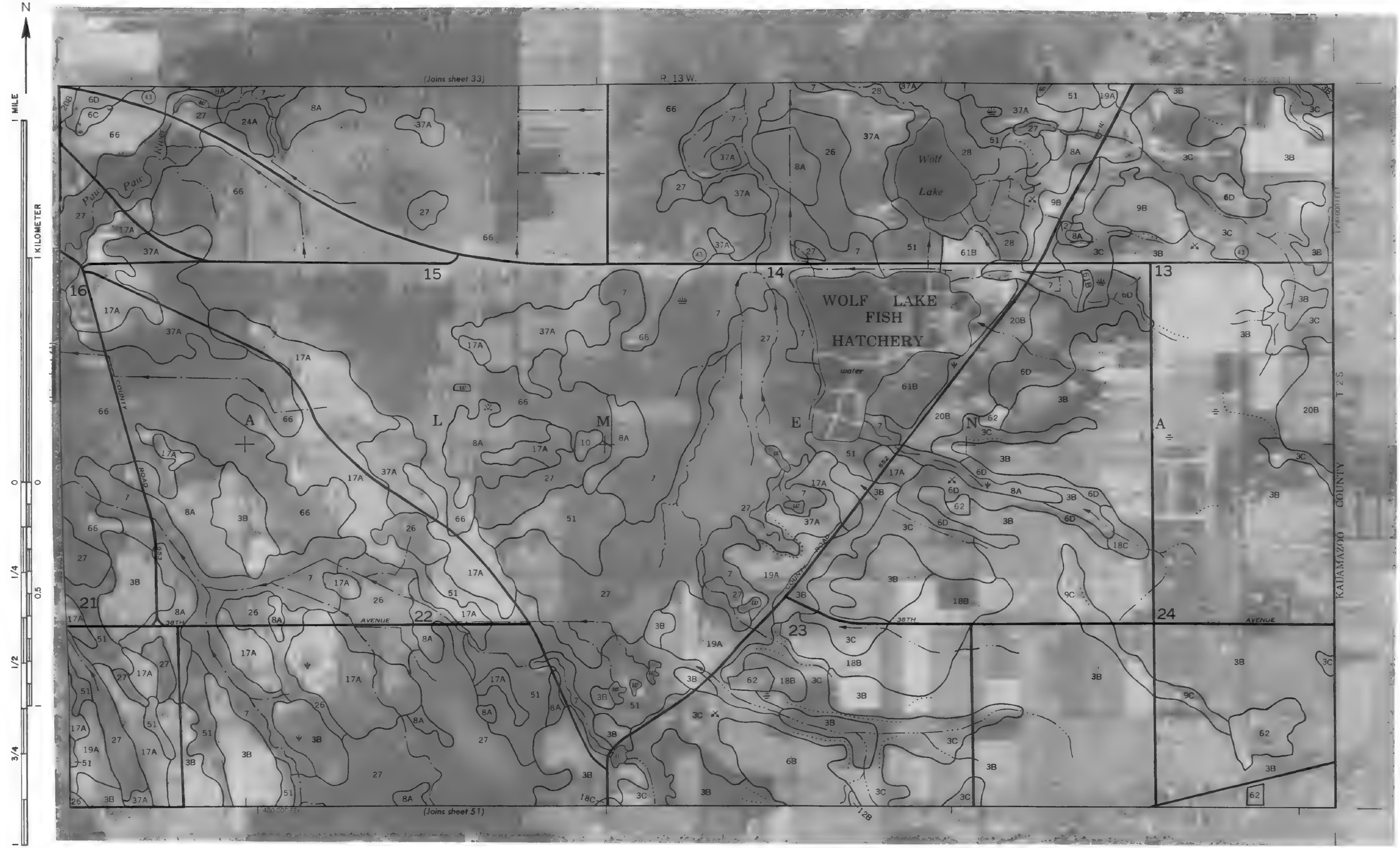


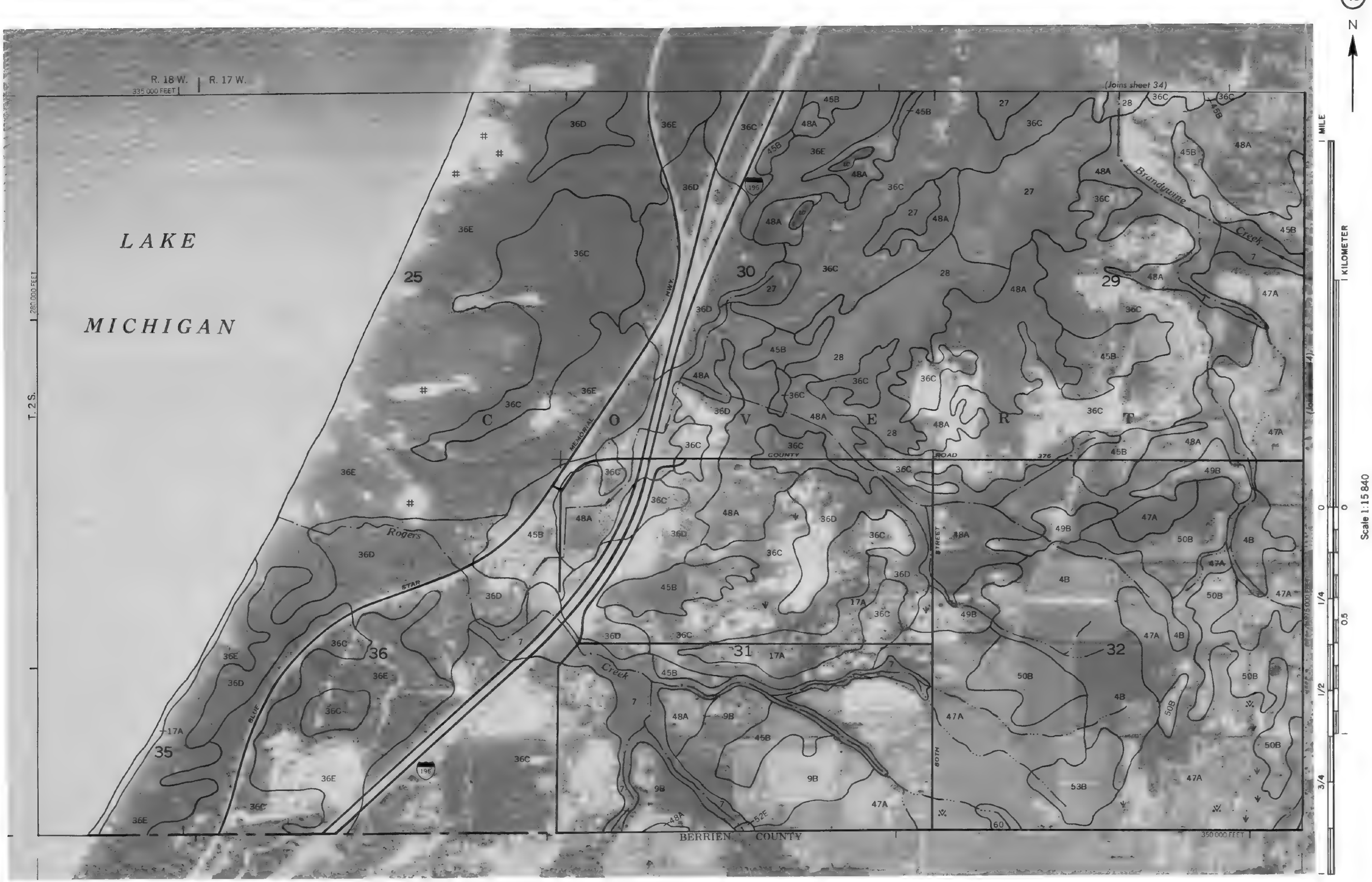

38
N
1 MILE
KILOMETER
Scale 1:15 840
(Joins sheet 29)
R. 15 W.
420 000 FEET
(Joins sheet 37)
(Joins sheet 39)
T. 2 S.
(Joins sheet 47)
A R L I N G T O N
COUNTY ROAD
STREET
ROAD
18
17
16
15
19
20
21
22

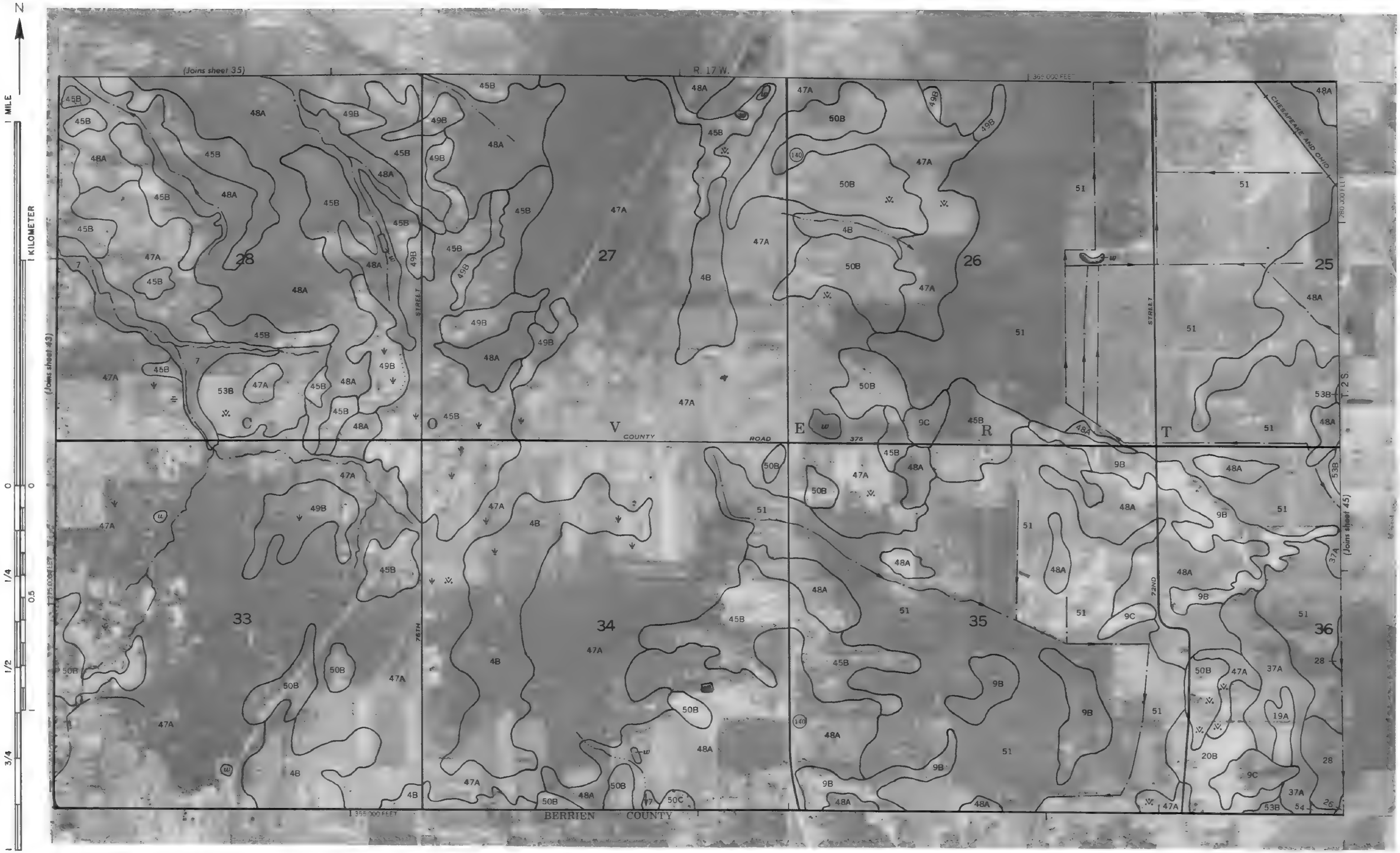

N
(Joins sheet 30)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 48)
425 000 FEET
440 000 FEET
R. 15 W.
R. 14 W.
T. 2 S.
Lake Fourteen
Black River Drain
water
38TH AVENUE
38TH STREET
48TH STREET
COUNTY ROAD
A R L I N G T O N
W A V E R L Y
14
13
18
17
23
24
19
20
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
(Joins sheet 31)
R. 14 W.
Glendale
School Section Lake
Round Lake
Davis Lake
Shaw Lake
Simmons Lake
Brandywine
Creek
Spring Run
water
W A V E R L Y
17
16
15
14
20
21
22
23
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 49)
T. 2 S.
COUNTY ROAD
40TH STREET
COUNTY ROAD 665

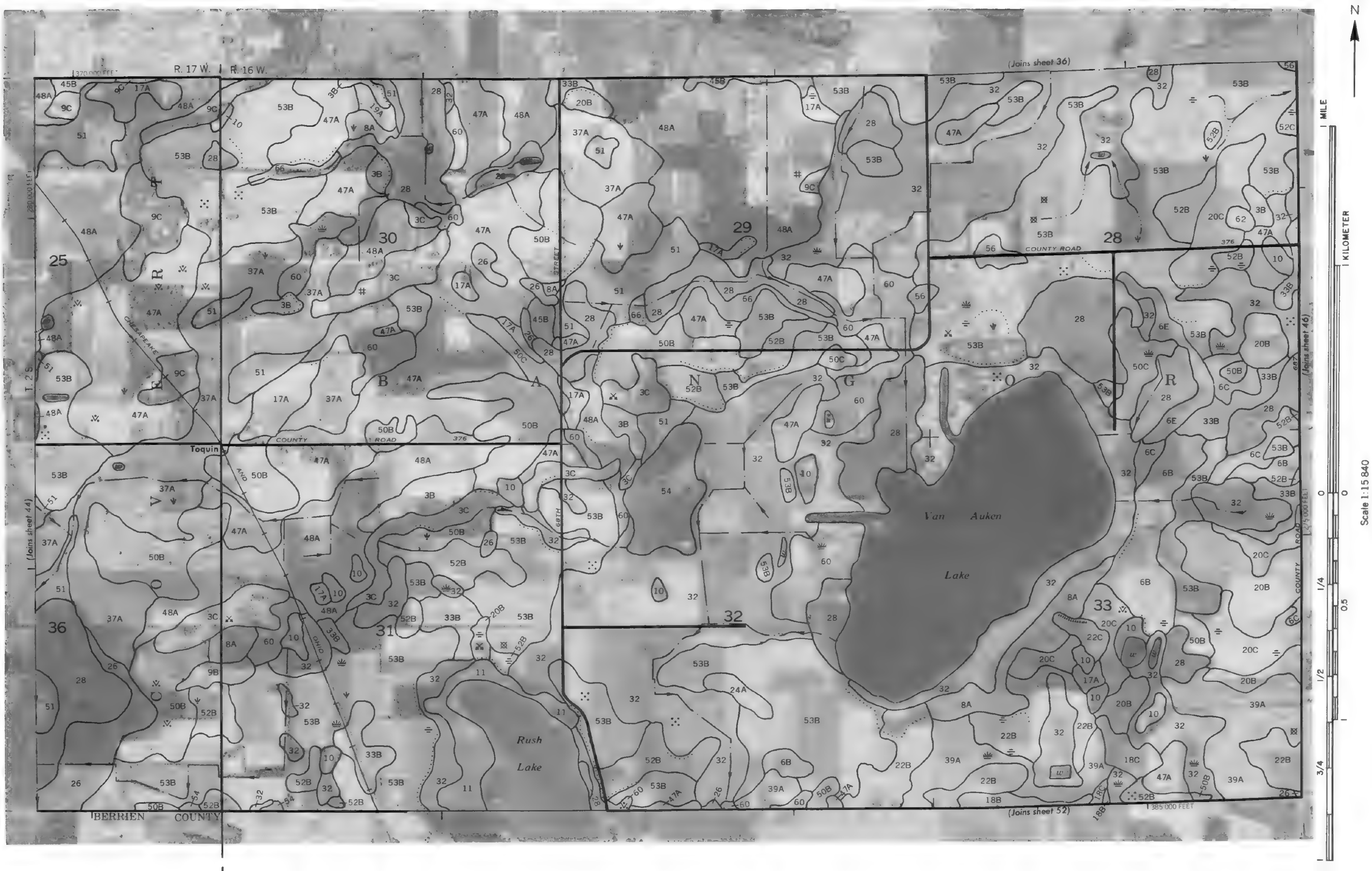

R. 14 W.
R. 13 W.
(Joins sheet 32)
(Joins sheet 40)
(Joins sheet 50)
T. 2 S.
L
A
W
R
E
N
C
E
A
L
M
E
N
A
Paw Paw River
North Branch
Brandywine Creek
36TH AVENUE
32ND STREET
13
16
17
18
19
20
21
24
N
1 MILE
1 KILOMETER
Scale 1:15 840

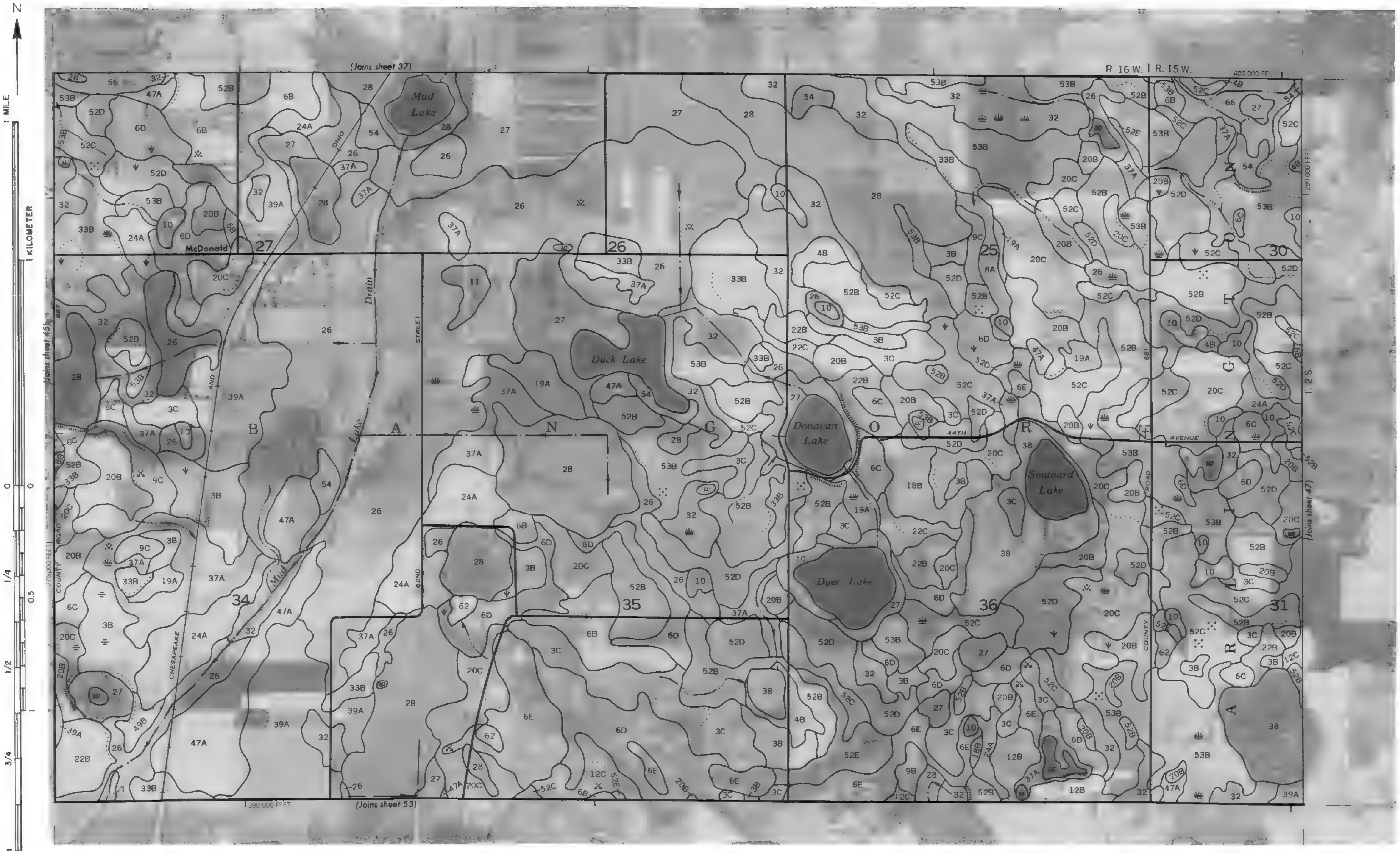

N
1 MILE
1 KILOMETER
0
1/4
0.5
1/2
3/4
(Joins sheet 33)
R. 13 W.
(Joins sheet 51)
WOLF LAKE FISH HATCHERY
Wolf Lake
Paw Paw River
ALMENA
KALAMAZOO COUNTY
T. 2 S.
COUNTY ROAD
38TH AVENUE
15
14
13
16
21
22
23
24


43
N
R. 18 W.
R. 17 W.
335 000 FEET
(Joins sheet 34)
LAKE
MICHIGAN
T. 2 S.
280 000 FEET
COVERT
25
30
29
36
31
32
35
MEMORIAL HWY.
196
Brandywine Creek
Rogers Creek
BLUE STAR
COUNTY ROAD 376
80TH STREET
BERRIEN COUNTY
350 000 FEET
MILE
KILOMETER
Scale 1:15 840


N
MILE
KILOMETER
0
1/4
1/2
3/4
0
0.5
(Joins sheet 35)
R. 17 W.
365 000 FEET
280 000 FEET
275 000 FEET
355 000 FEET
(Joins sheet 43)
(Joins sheet 45)
T. 2 S.
28
27
26
25
33
34
35
36
C O V E R T
COUNTY ROAD 378
76TH STREET
72ND STREET
STREET
CHESAPEAKE AND OHIO
140
BERRIEN COUNTY

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 45

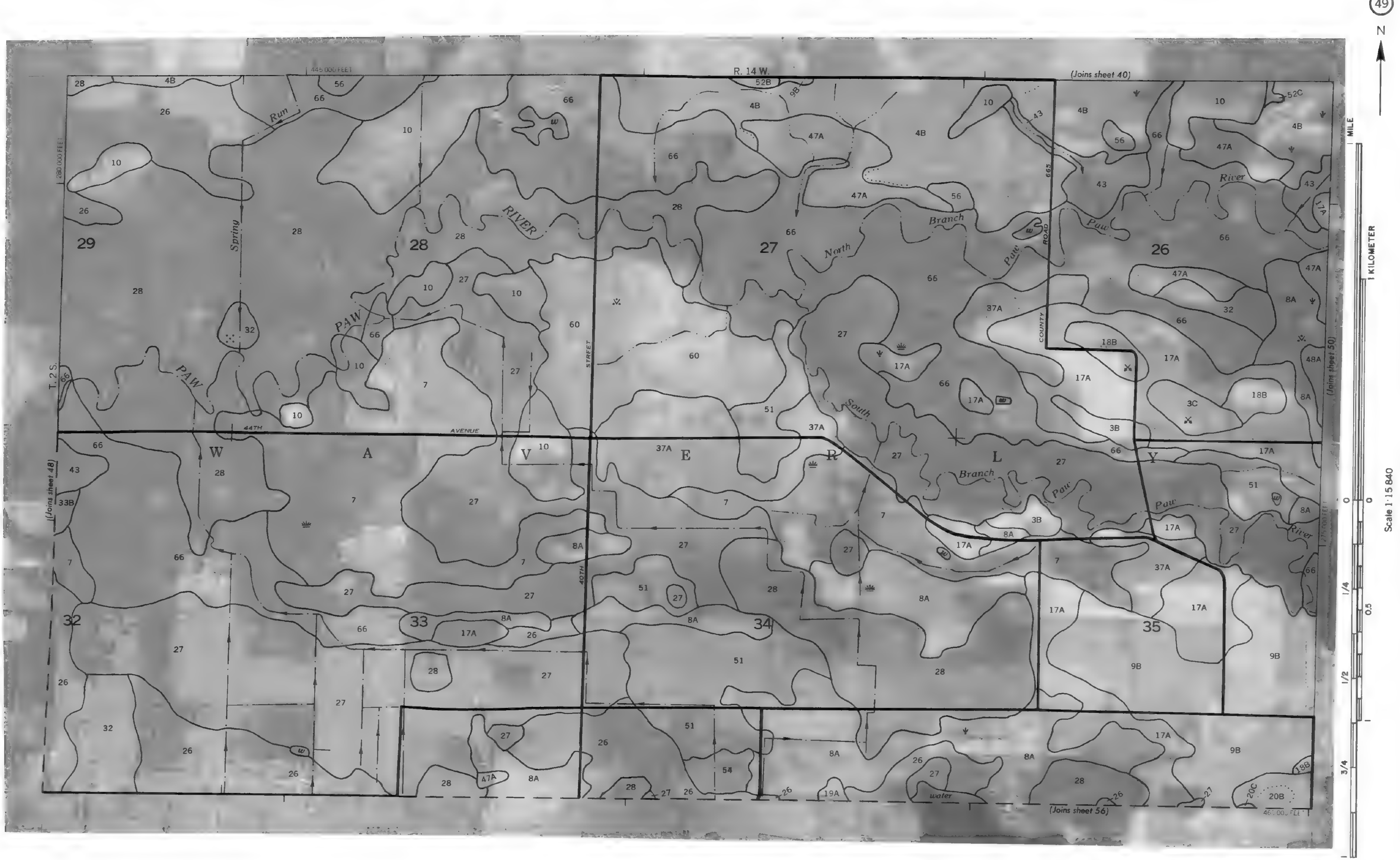



N
1 MILE
1 KILOMETER
(Joins sheet 37)
(Joins sheet 53)
(Joins sheet 45)
(Joins sheet 47)
R. 16 W. | R. 15 W.
T. 2 S.
405 000 FEET
390 000 FEET
375 000 FEET
280 000 FEET
Mud Lake
Duck Lake
Donavan Lake
Southard Lake
Dyer Lake
McDonald
Mud Lake Drain
OHIO
CHESAPEAKE AND OHIO
62ND STREET
44TH AVENUE
COUNTY ROAD 687
COUNTY ROAD 681
B A N G O R
A R L I N G T O N
25
26
27
30
31
34
35
36

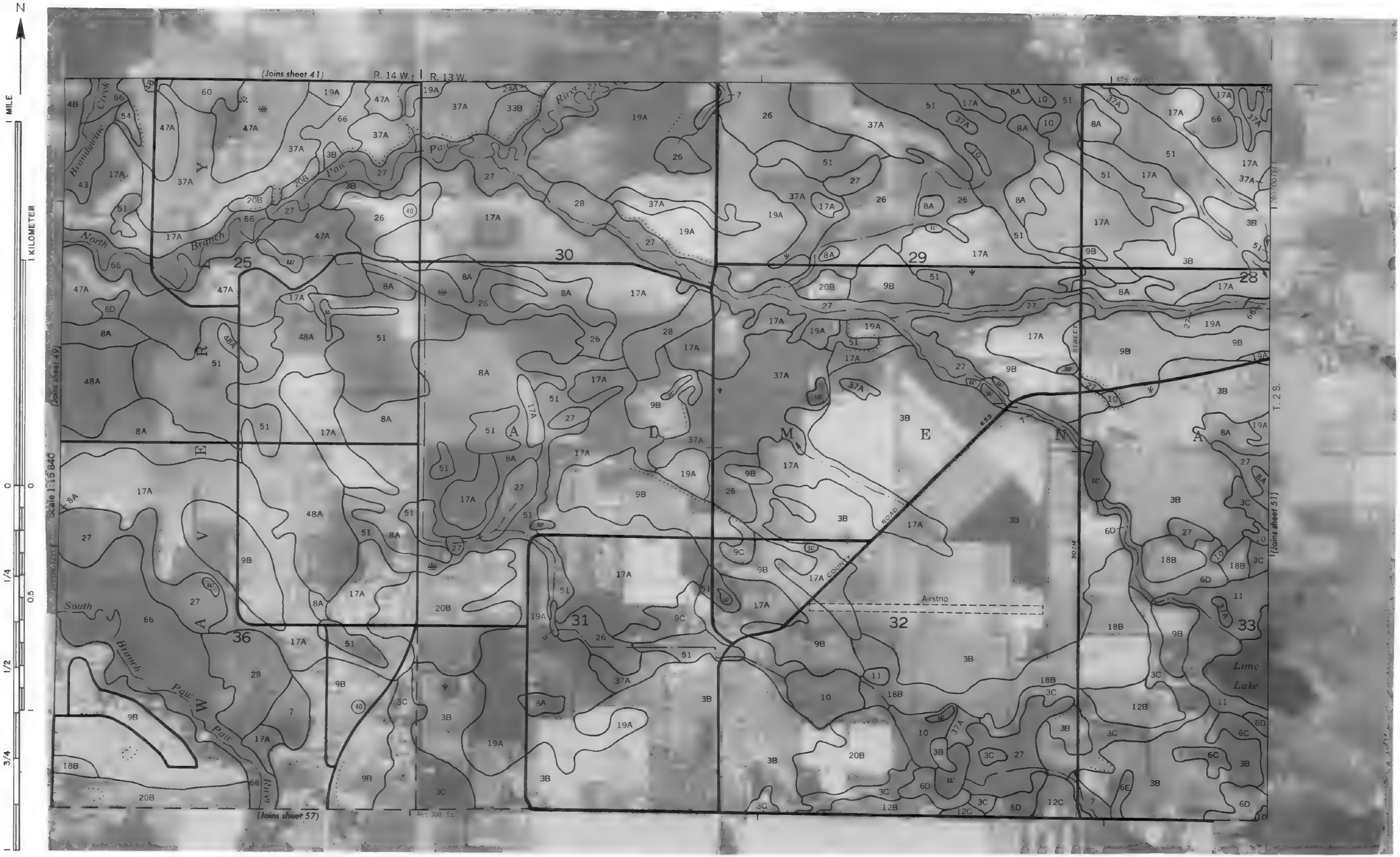

N
R. 15 W.
(Joins sheet 38)
(Joins sheet 54)
410 000 FEET
420 000 FEET
30
29
28
27
31
32
33
34
A
R
L
I
N
G
T
O
N
44TH
AVENUE
COUNTY
ROAD
215
Hilloher Lake
Carroll Lake
Nicholas Lake
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1

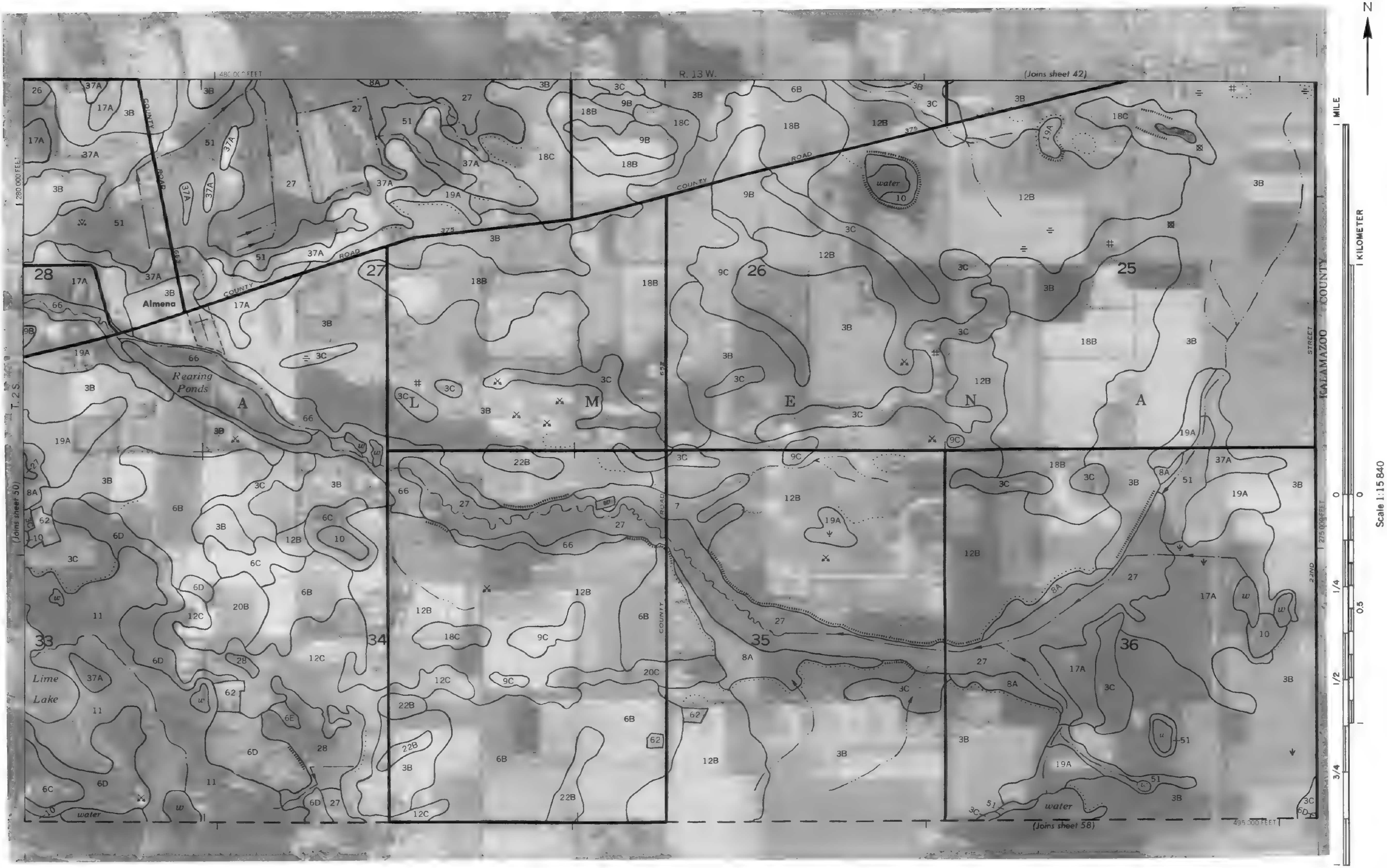
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 48

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 49

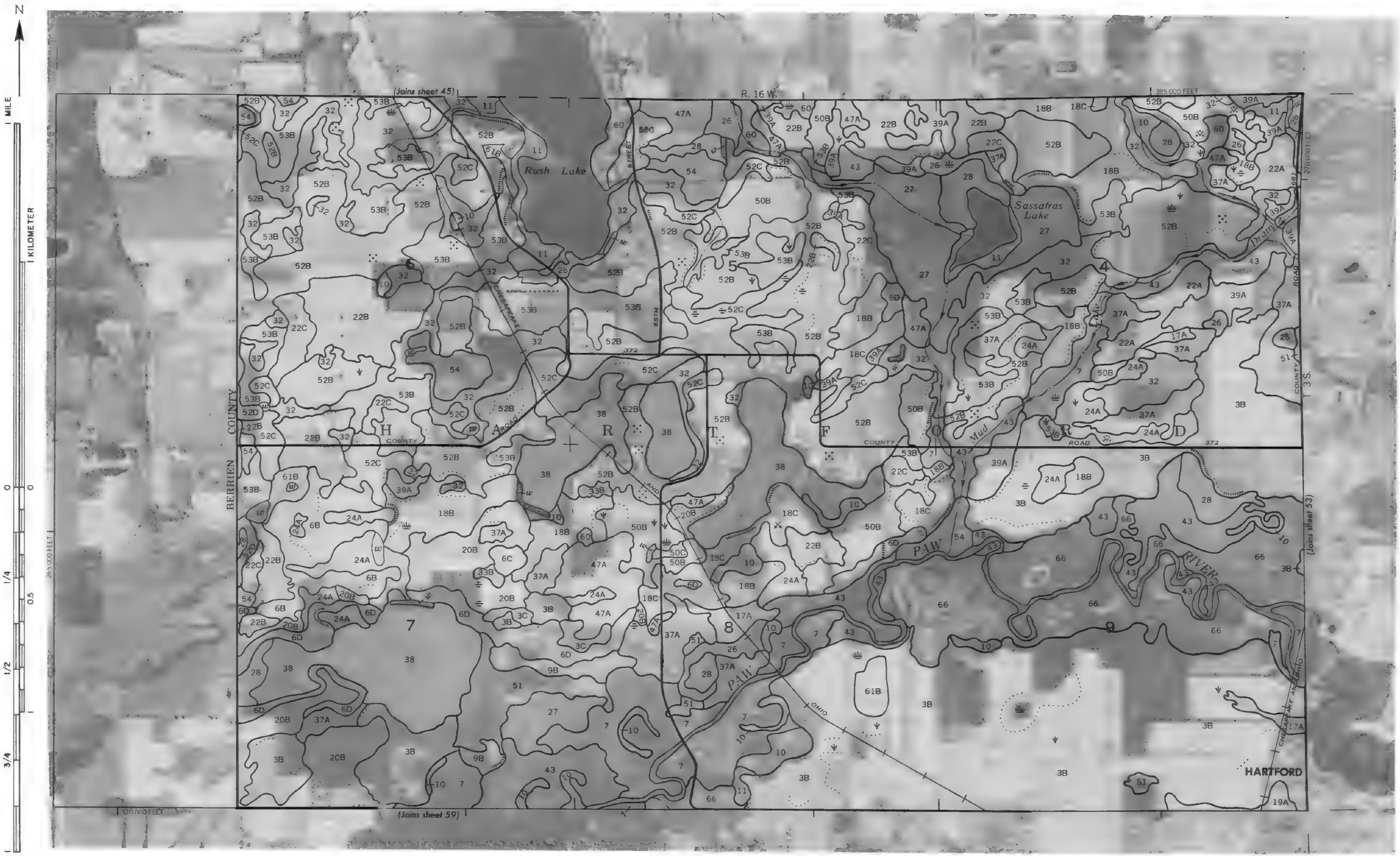


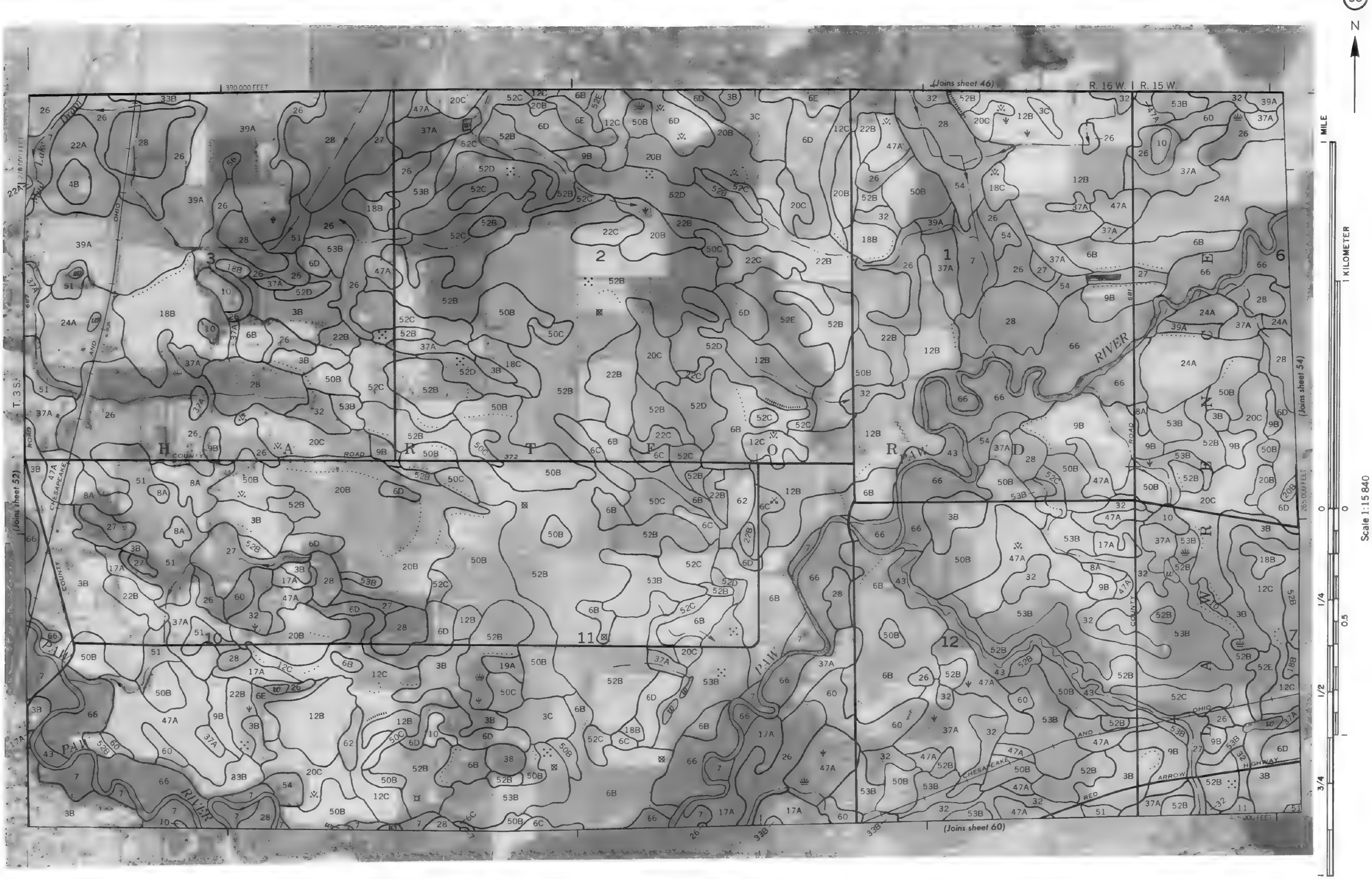
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 50



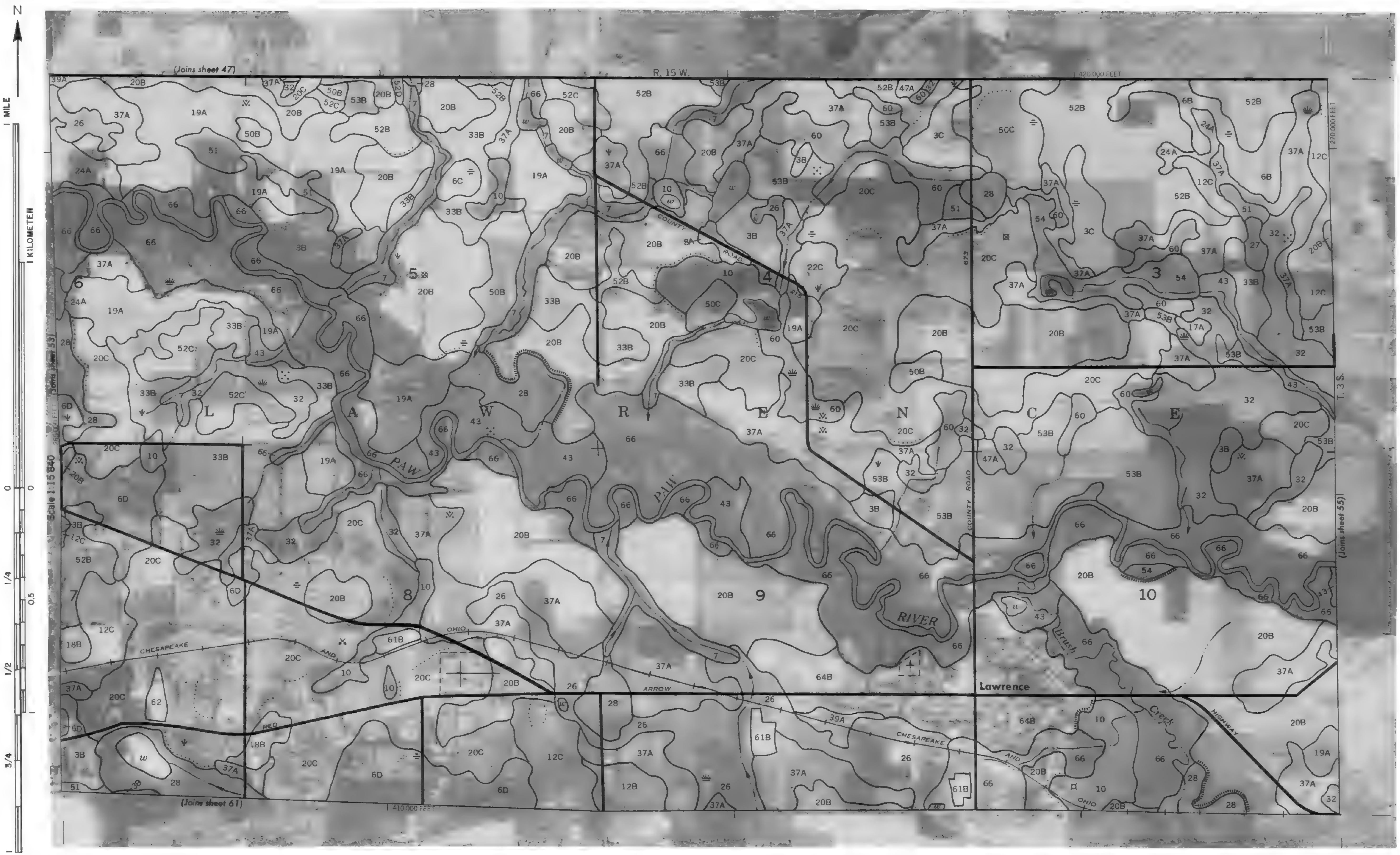

N
R. 13 W.
(Joins sheet 42)
(Joins sheet 50)
(Joins sheet 58)
480 000 FEET
280 000 FEET
275 000 FEET
495 000 FEET
T. 2 S.
ALMENA
Almena
COUNTY ROAD
ROAD
375
653
652
Rearing Ponds
Lime Lake
water
KALAMAZOO COUNTY
22ND STREET
28
27
26
25
33
34
35
36
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
Scale 1:15 840

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 52



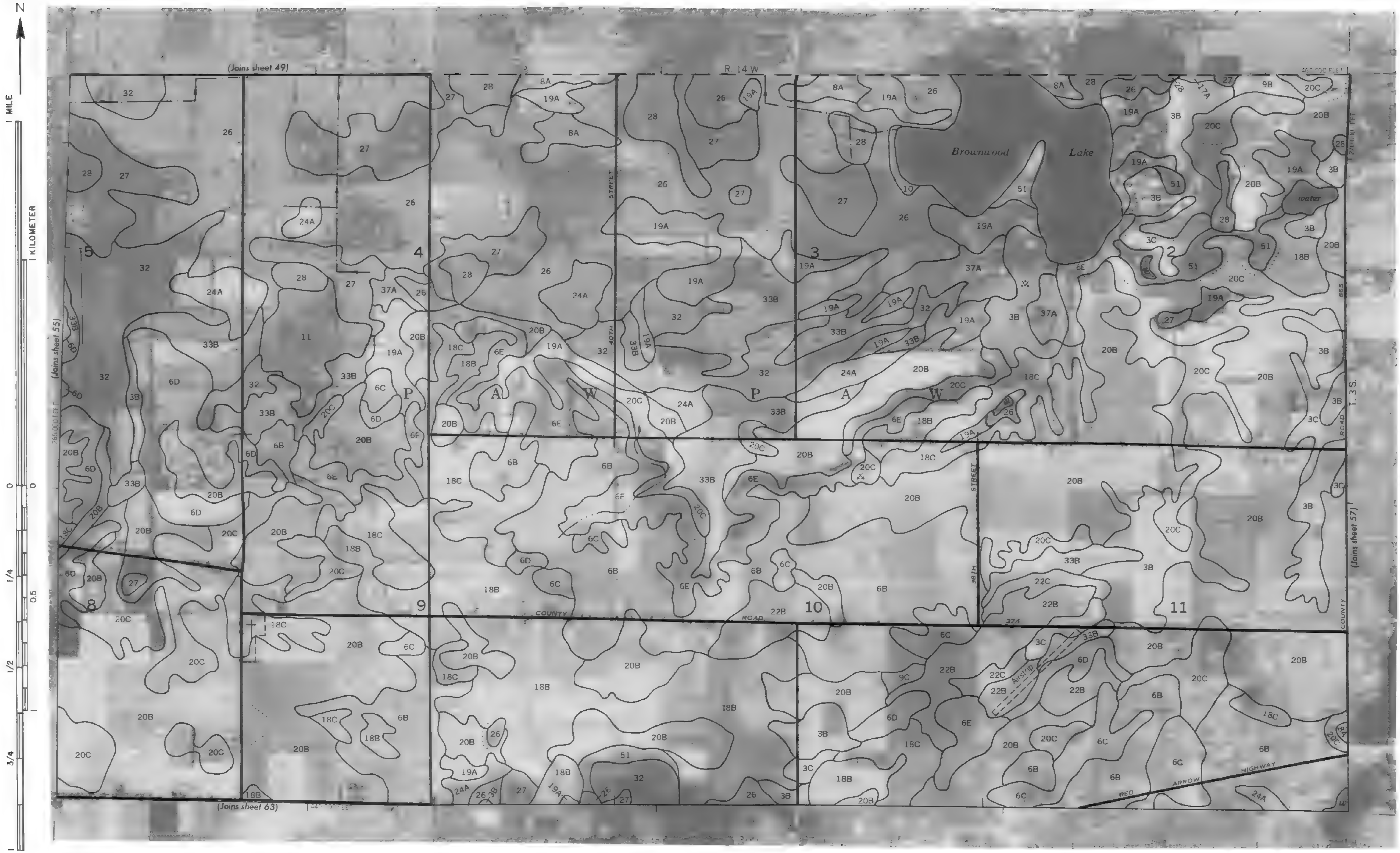

53
N
(Joins sheet 46)
R. 16 W.
R. 15 W.
390 000 FEET
T. 3 S.
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 60)
265 000 FEET
PAW PAW RIVER
HARTFORD
COUNTY ROAD 372
CHESAPEAKE AND OHIO
RED ARROW HIGHWAY
1 MILE
1 KILOMETER
Scale 1:15 840

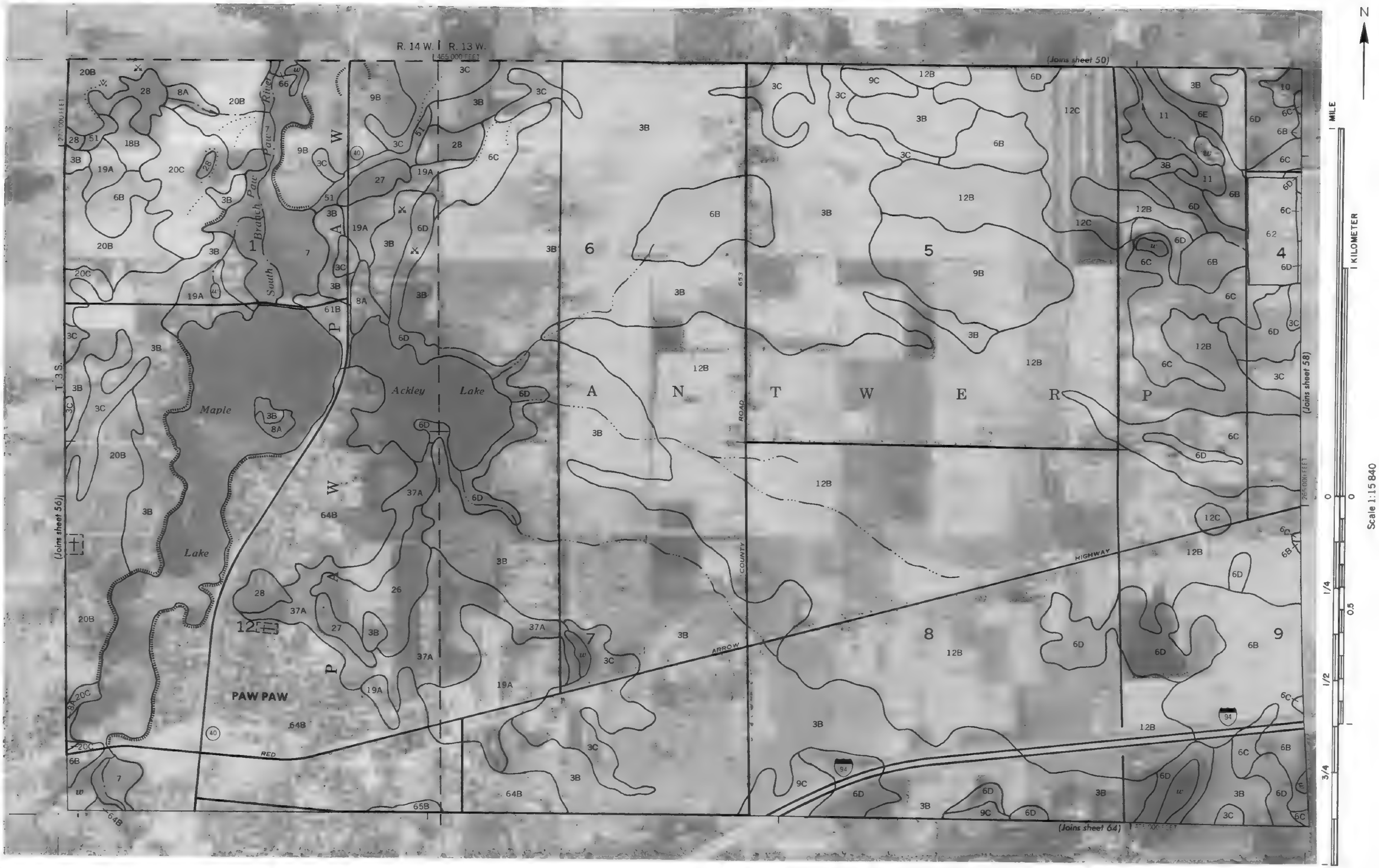
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 54

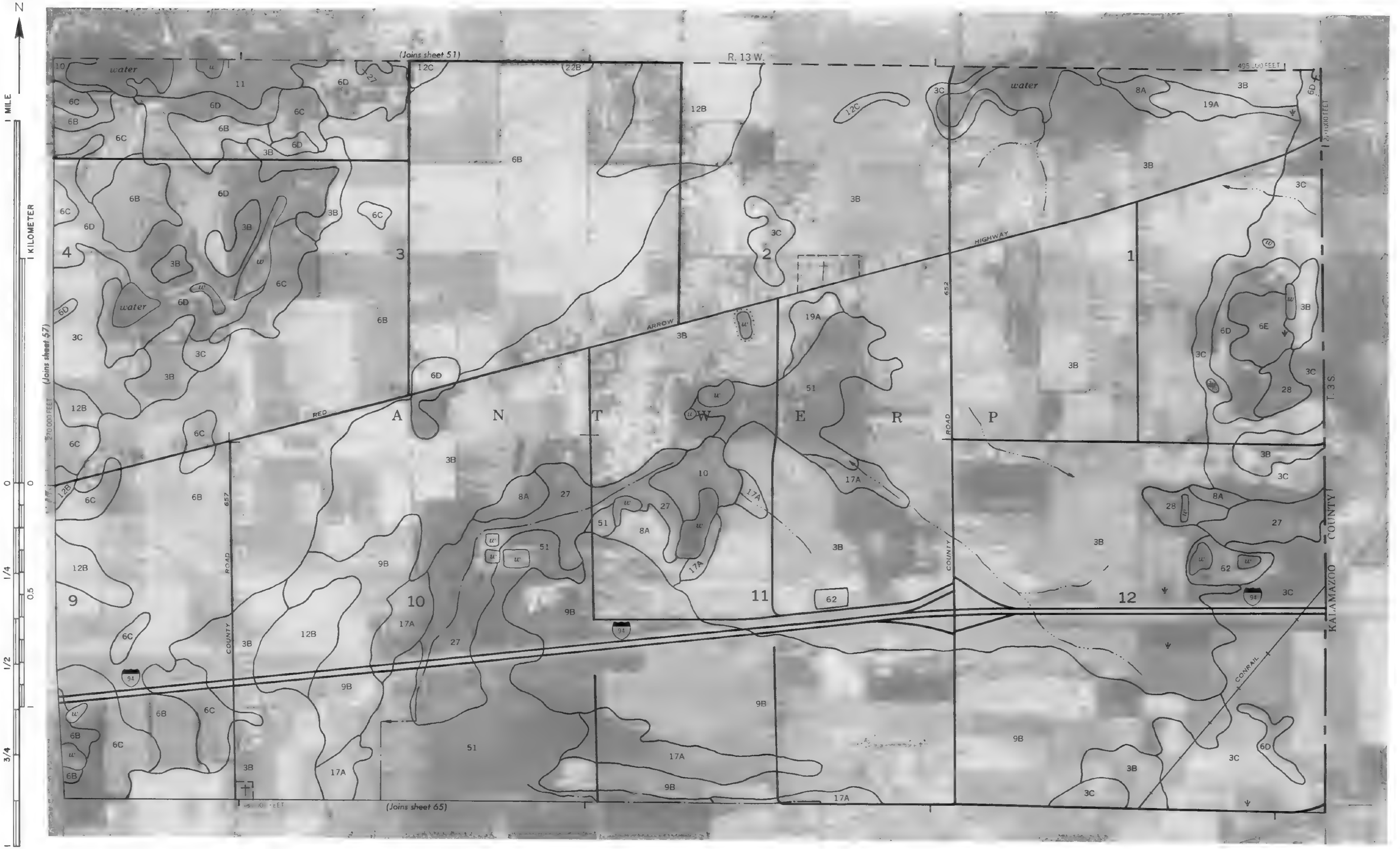


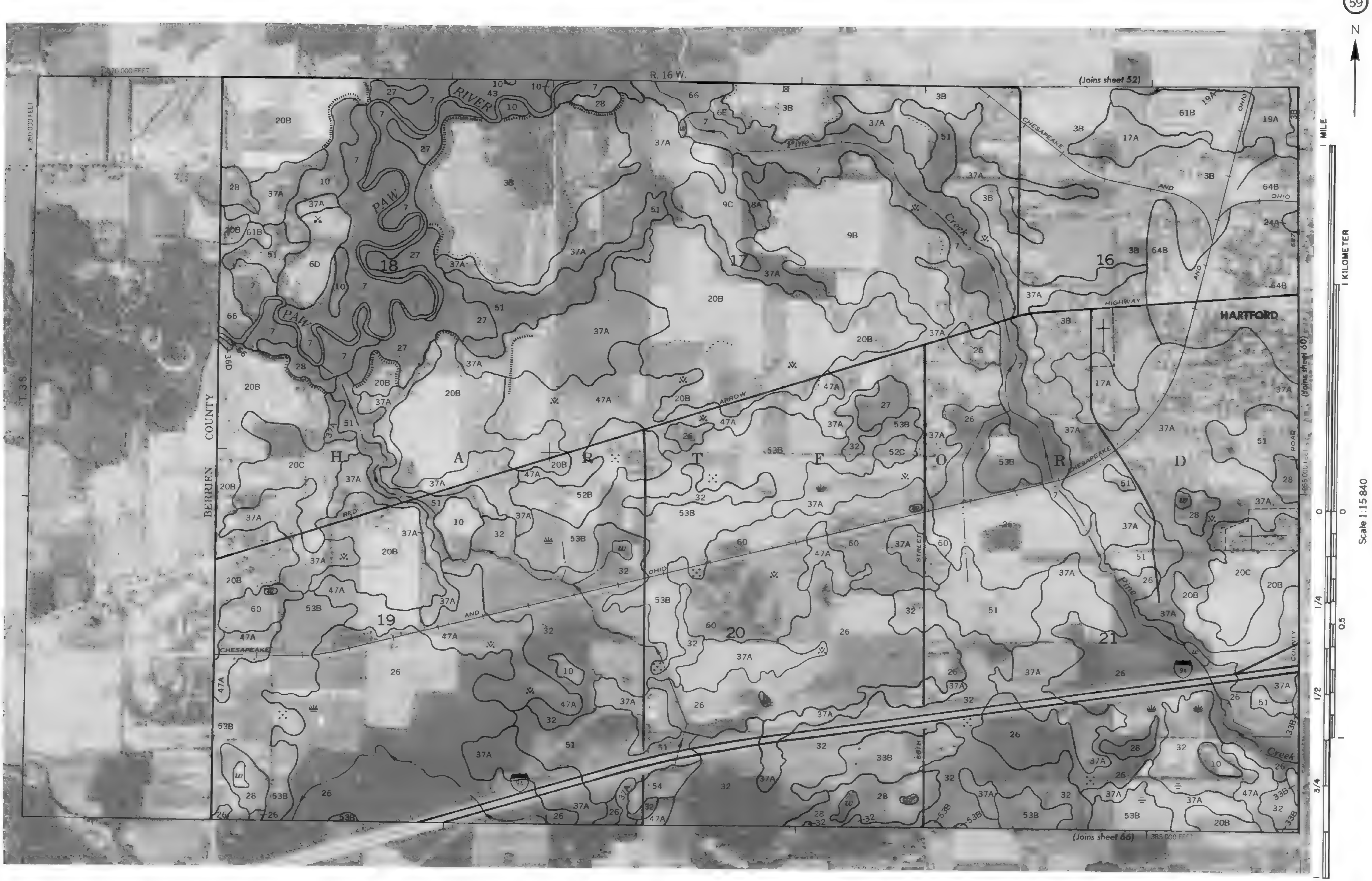

(Joins sheet 48)
(Joins sheet 62)
(Joins sheet 54)
(Joins sheet 56)
R. 15 W.
R. 14 W.
T. 3 S.
425 000 FEET
270 000 FEET
265 000 FEET
440 000 FEET
L A W R E N C E
P A W P A W
PAW PAW RIVER
Nelson Lake
Bullhead Lake
Airstrip
COUNTY ROAD 374
48TH STREET
44TH STREET
RED ARROW HIGHWAY
1
2
5
6
7
8
11
12
N
MILE
KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 56



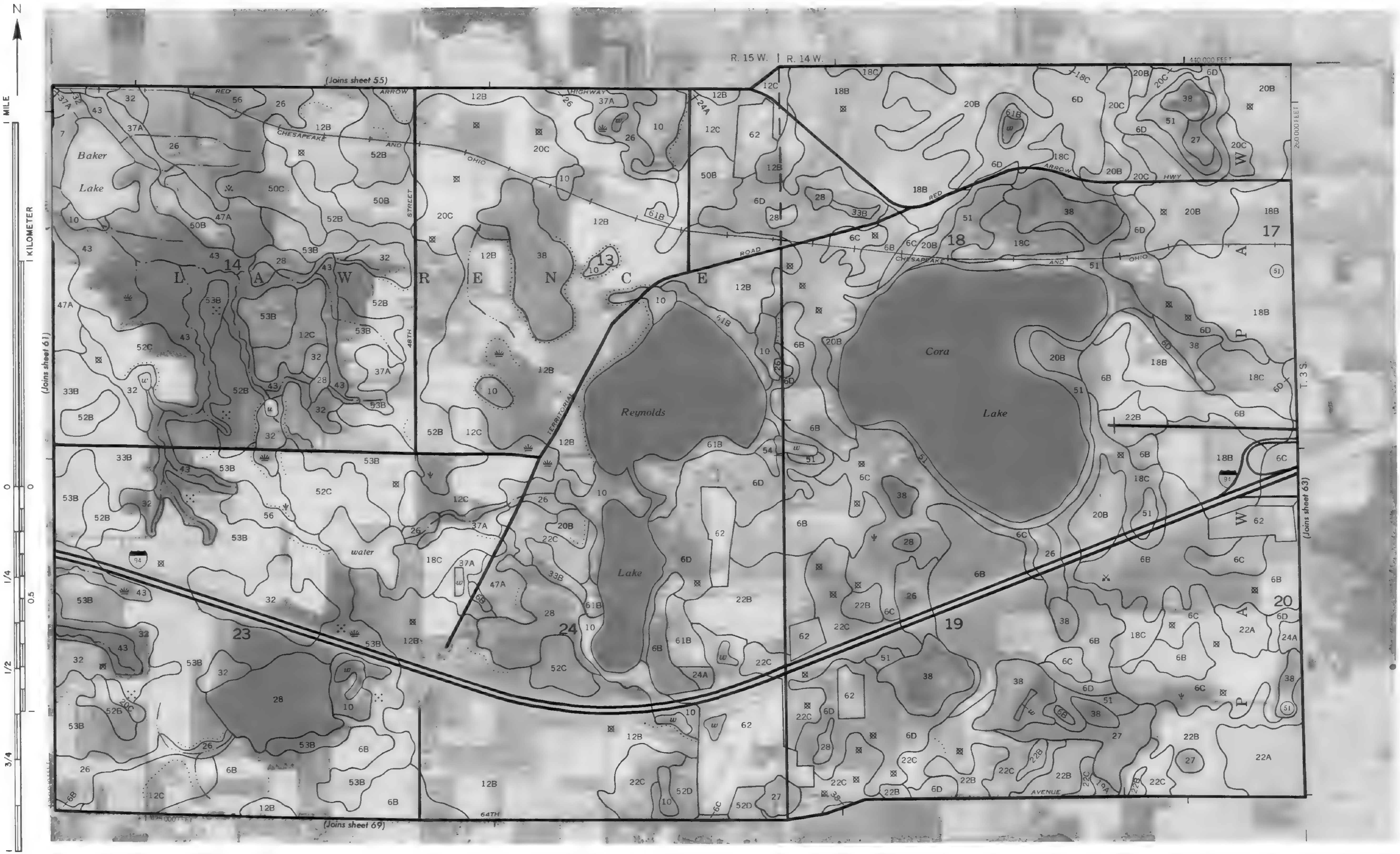

N
R. 14 W.
R. 13 W.
(Joins sheet 50)
(Joins sheet 58)
(Joins sheet 64)
(Joins sheet 56)
T. 3 S.
PAW PAW
Maple
Lake
Ackley
Lake
South
Branch
Paw
Paw
River
P A W
P A W
A N T W E R P
COUNTY
ROAD
653
RED
ARROW
HIGHWAY
94
40
1
4
5
6
7
8
9
12
MILE
KILOMETER
0
1/4
1/2
3/4
1
0.5
Scale 1:15 840


N
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
(Joins sheet 51)
R. 13 W.
(Joins sheet 57)
(Joins sheet 65)
T. 3 S.
KALAMAZOO COUNTY
ARROW
HIGHWAY
RED
A N T W E R P
COUNTY ROAD 652
COUNTY ROAD 657
CONRAIL
water
1
2
3
4
9
10
11
12

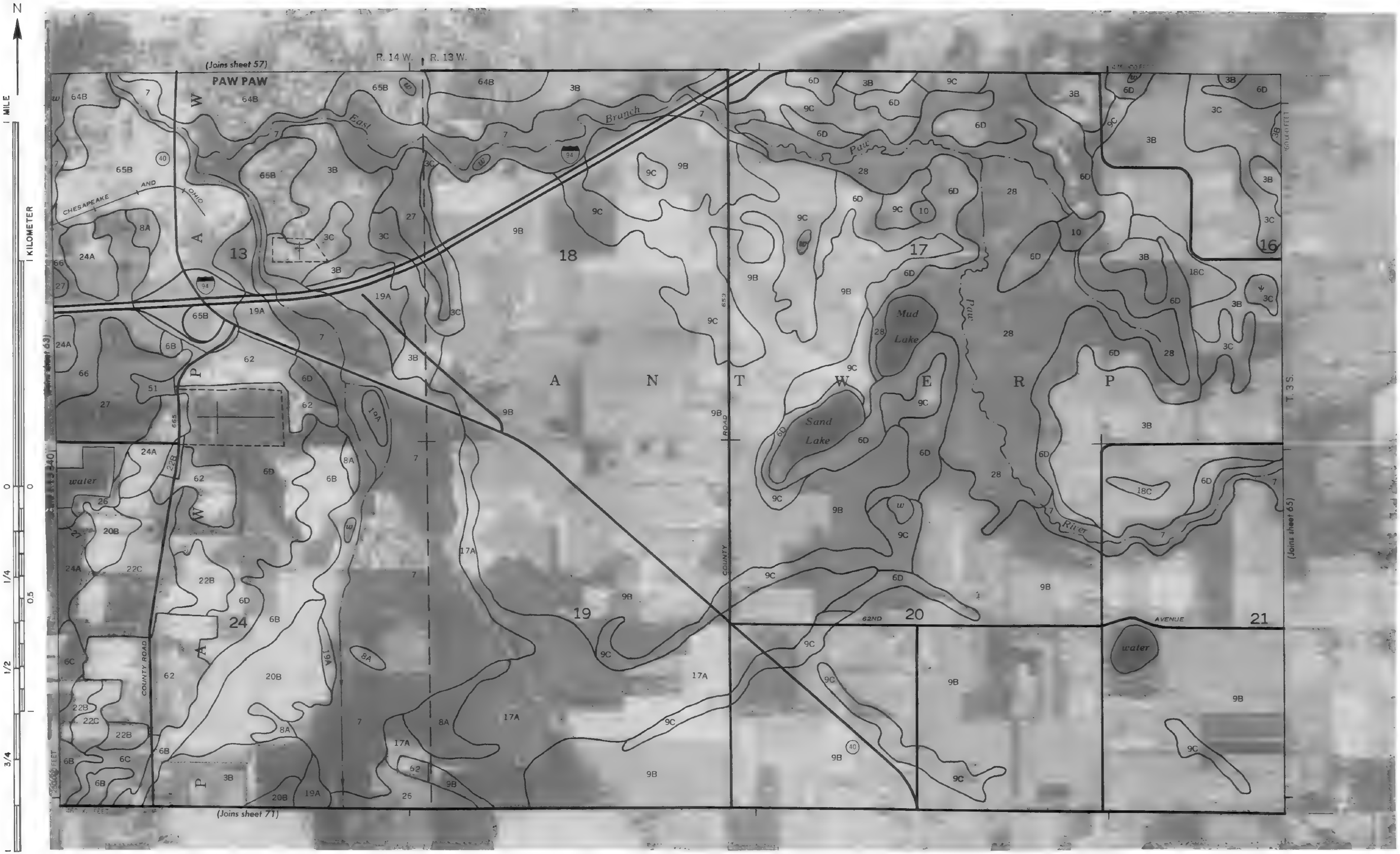

59
N
R. 16 W.
(Joins sheet 52)
(Joins sheet 60)
(Joins sheet 66)
T. 3 S.
BERRIEN COUNTY
PAW PAW RIVER
Pine Creek
HARTFORD
H A R T F O R D
RED ARROW HIGHWAY
CHESAPEAKE AND OHIO
COUNTY ROAD 687
60TH STREET
16
17
18
19
20
21
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 53)
(Joins sheet 61)
(Joins sheet 67)
R. 16 W.
R. 15 W.
T. 3 S.
HARTFORD
H A R T F O R D
W I L E R N E W
Hall Lake
Shafer Lake
PAW PAW RIVER
Hog Creek
Pine Creek
CHESAPEAKE AND OHIO
RED ARROW HIGHWAY
62ND AVENUE
62ND STREET
COUNTY ROAD
15
14
13
18
22
23
24
19
94


61
N
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 68)
(Joins sheet 60)
R. 15 W.
T. 3 S.
Hall Lake
Cornwall Lake
Airstrip
COUNTY ROAD 215
COUNTY ROAD
Brush Creek
CHESAPEAKE AND OHIO
L A W R E N C E
94
17
16
15
18
19
20
21
22
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

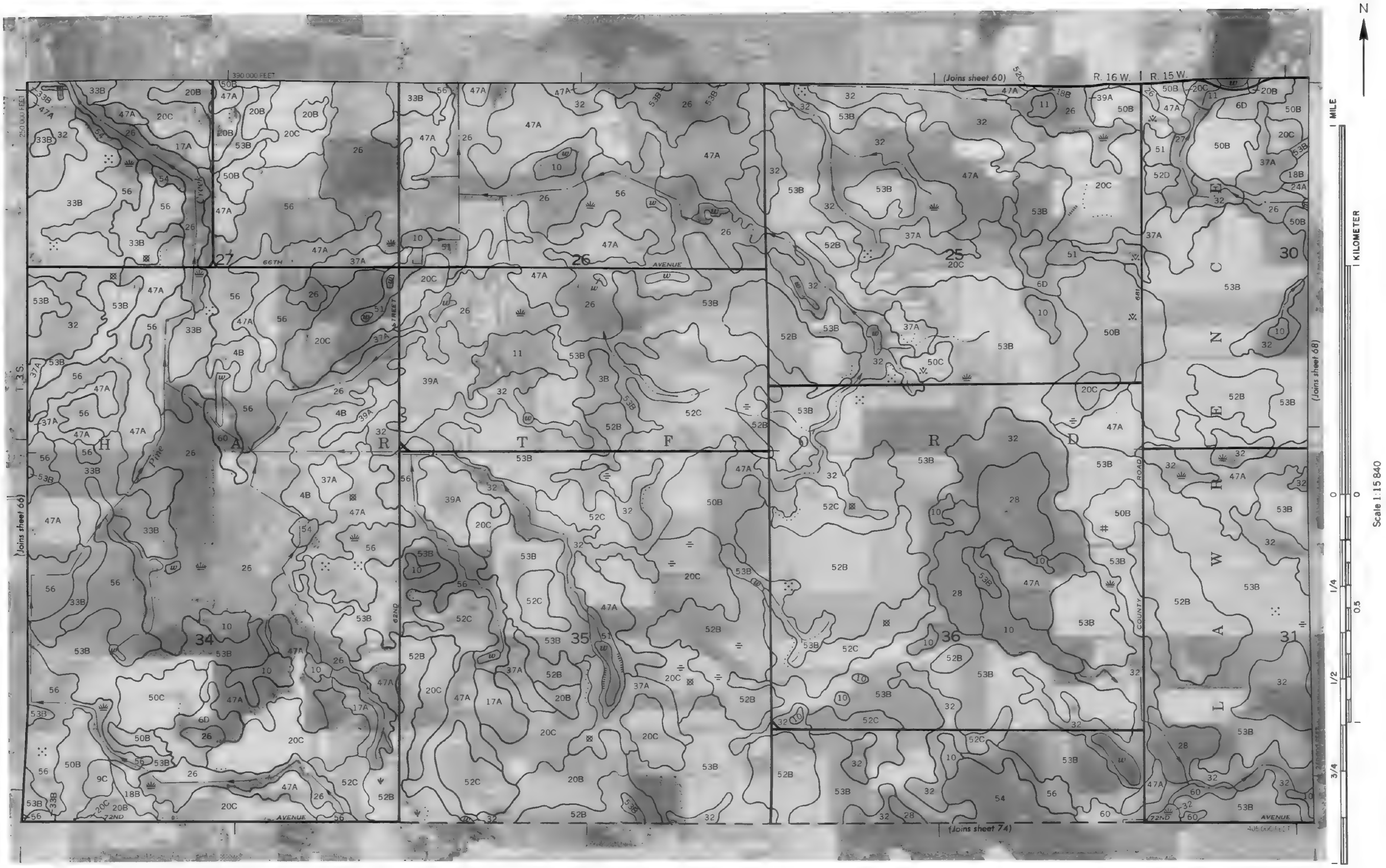

62
N
MILE
KILOMETER
0
1/4
0.5
1/2
3/4
1
(Joins sheet 55)
(Joins sheet 61)
(Joins sheet 63)
(Joins sheet 69)
R. 15 W.
R. 14 W.
T. 3 S.
440 000 FEET
240 000 FEET
Baker Lake
Reynolds Lake
Cora Lake
water
L A W R E N C E
P A W P A W
RED ARROW HIGHWAY
CHESAPEAKE AND OHIO
48TH STREET
TERRITORIAL ROAD
64TH AVENUE
94
51
14
13
17
18
19
20
23
24


N
(Joins sheet 56)
(Joins sheet 62)
(Joins sheet 64)
(Joins sheet 70)
R. 14 W.
T. 3 S.
445 000 FEET
250 000 FEET
RED ARROW HIGHWAY
CHESAPEAKE AND OHIO
CHESAPEAKE AND OHIO ROAD
40TH STREET
Three Mile Lake
PAW PAW Lake
Threemile Lake
water
Drain
South Branch
Paw Paw River
P A W
17
16
15
14
20
21
22
23
1 MILE
1 KILOMETER
Scale 1:15 840

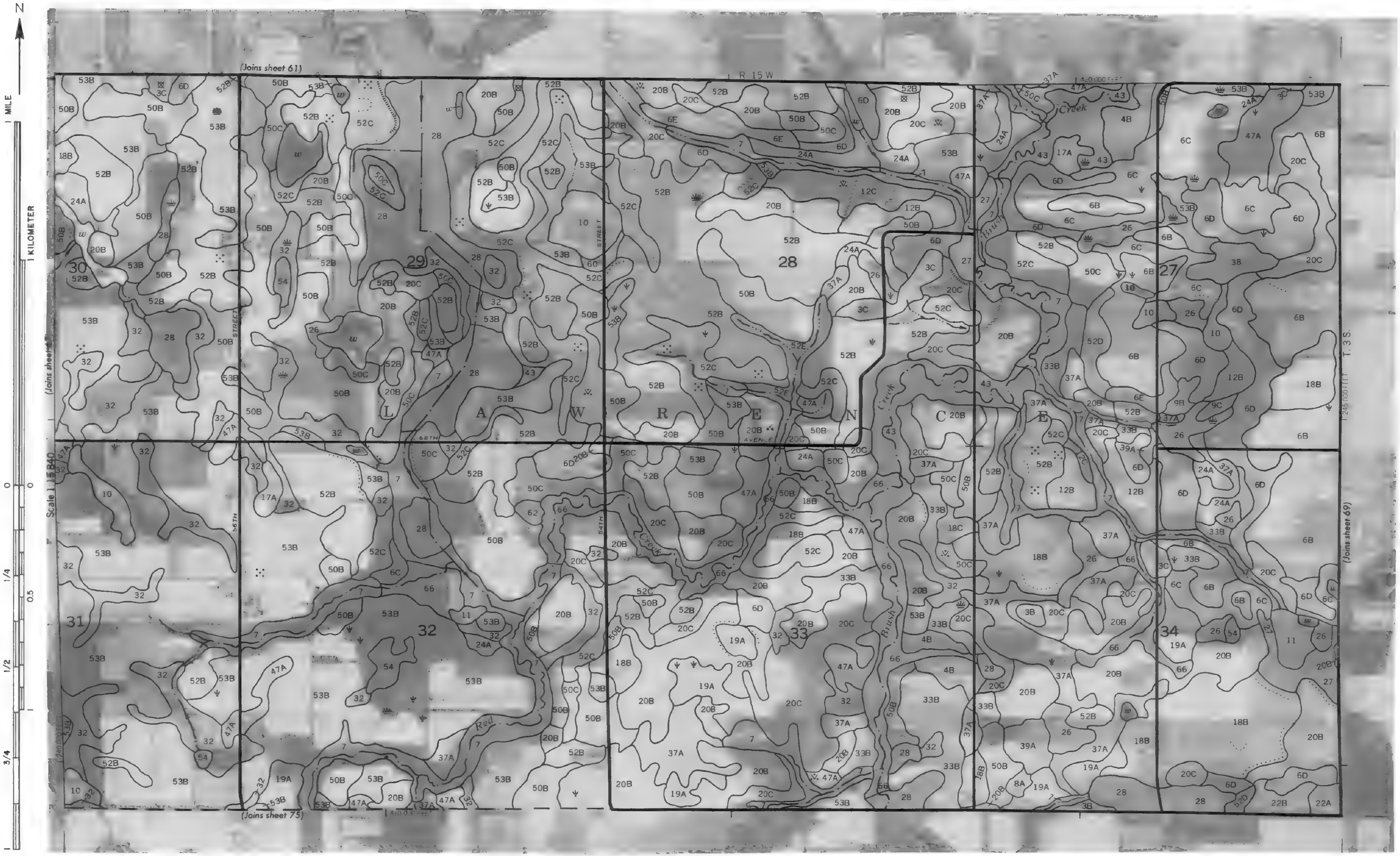

64
N
1 MILE
1 KILOMETER
(Joins sheet 57)
R. 14 W.
R. 13 W.
PAW PAW
CHESAPEAKE AND OHIO
East Branch
Paw Paw River
Mud Lake
Sand Lake
water
13
18
17
16
24
19
20
21
PAW PAW
ANTWERP
COUNTY ROAD 653
COUNTY ROAD
62ND AVENUE
T. 3 S.
(Joins sheet 65)
(Joins sheet 63)
(Joins sheet 71)

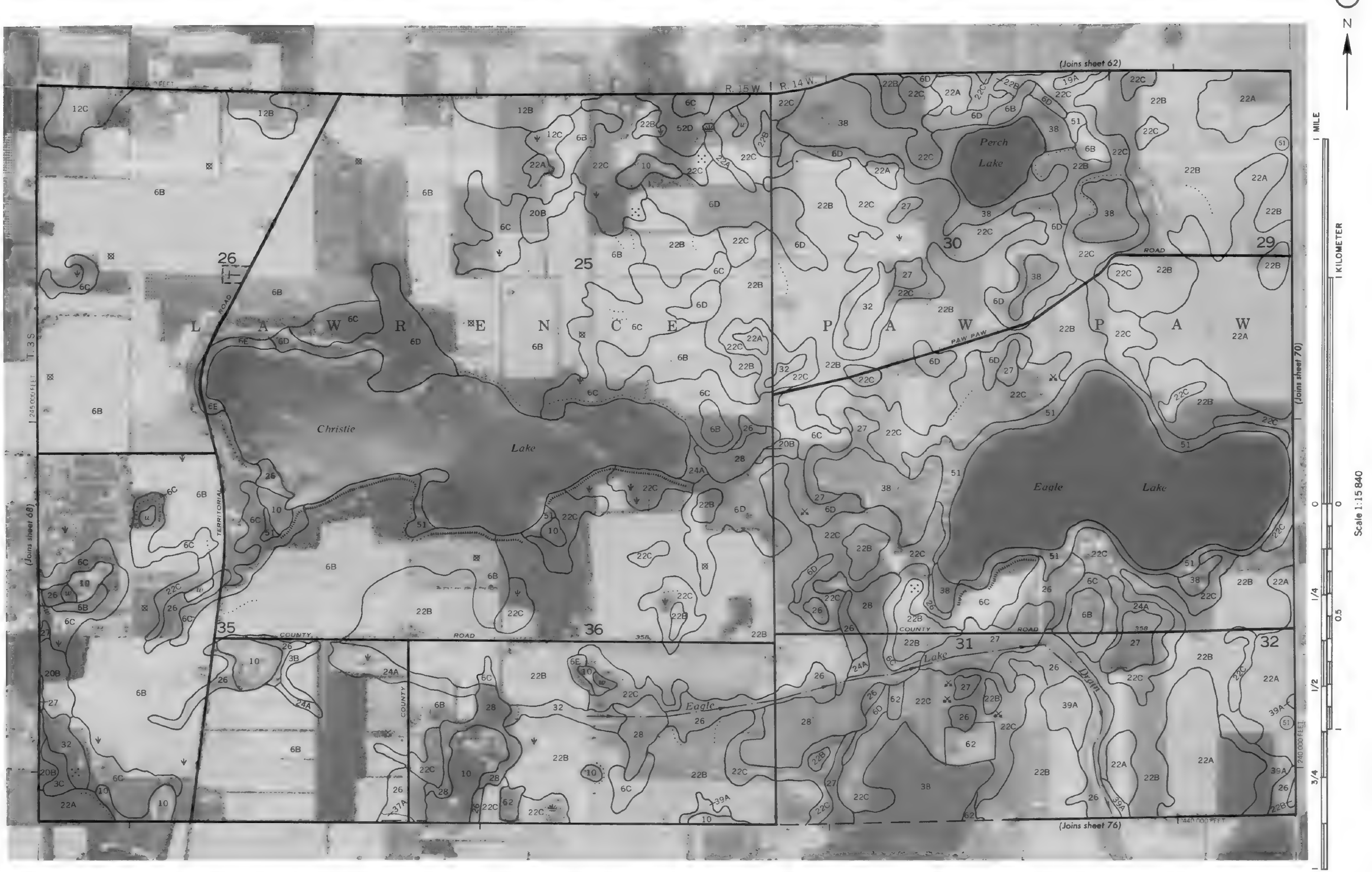

65
N
(Joins sheet 58)
(Joins sheet 72)
(Joins sheet 64)
R. 13 W.
T. 3 S.
480 000 FEET
260 000 FEET
250 000 FEET
495 000 FEET
MATTAWAN
ANTWERP
KALAMAZOO COUNTY
COUNTY ROAD 358
COUNTY ROAD 657
COUNTY ROAD 652
CONRAIL
South Branch Paw Paw River
16
15
14
13
21
22
23
24
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

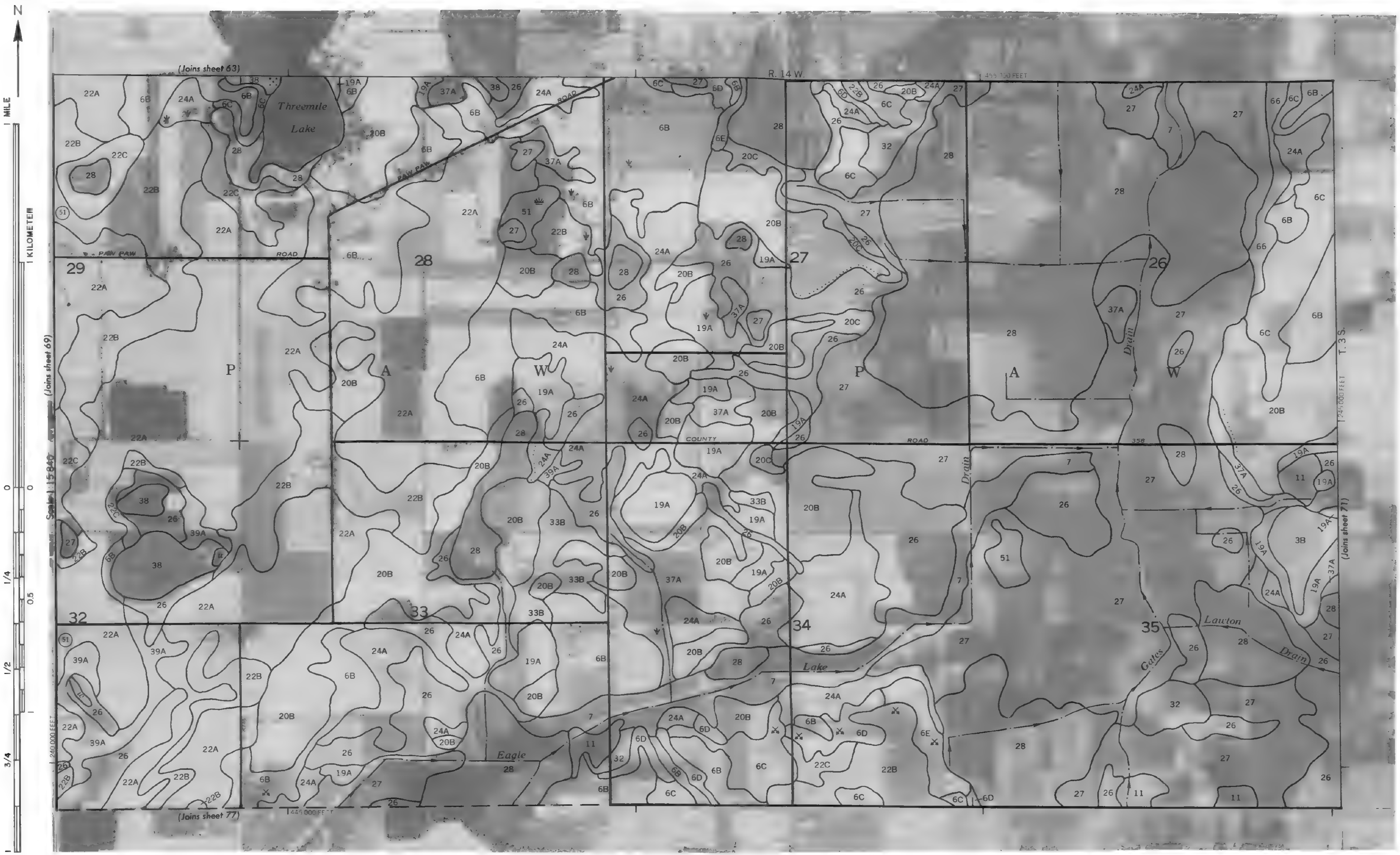

N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 59)
(Joins sheet 73)
(Joins sheet 67)
R. 16 W.
T. 3 S.
385 000 FEET
370 000 FEET
BERRIEN COUNTY
H A R T F O R D
66TH
66TH STREET
AVENUE
COUNTY ROAD 687
Pine Creek
28
29
30
31
32
33

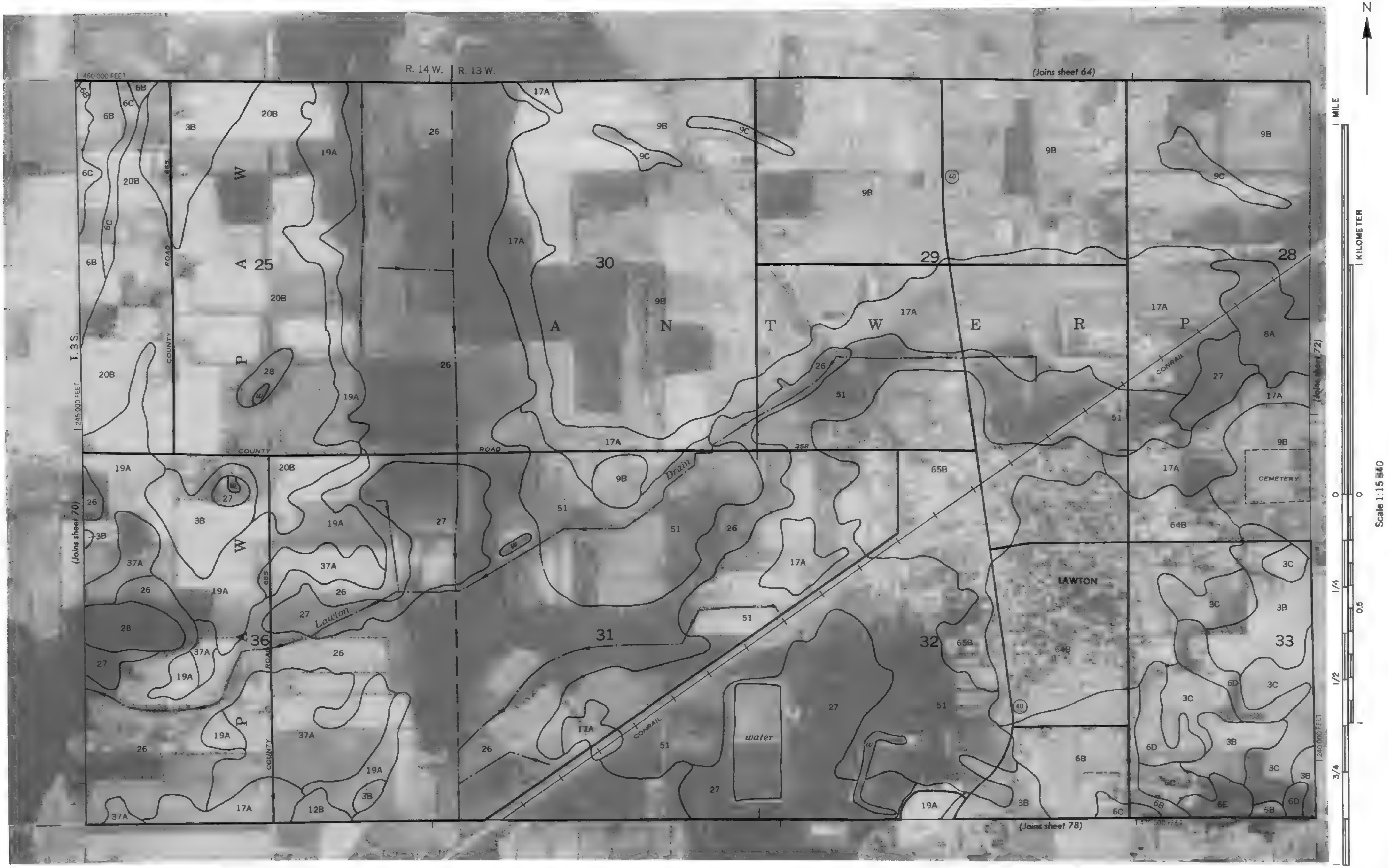

N
(Joins sheet 60)
R. 16 W.
R. 15 W.
390 000 FEET
250 000 FEET
T. 3 S.
(Joins sheet 66)
(Joins sheet 68)
(Joins sheet 74)
H A R T F O R D
L A W R E N C E
27
26
25
30
34
35
36
31
66TH AVENUE
72ND AVENUE
62ND STREET
COUNTY ROAD 681
Pine Creek
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 68

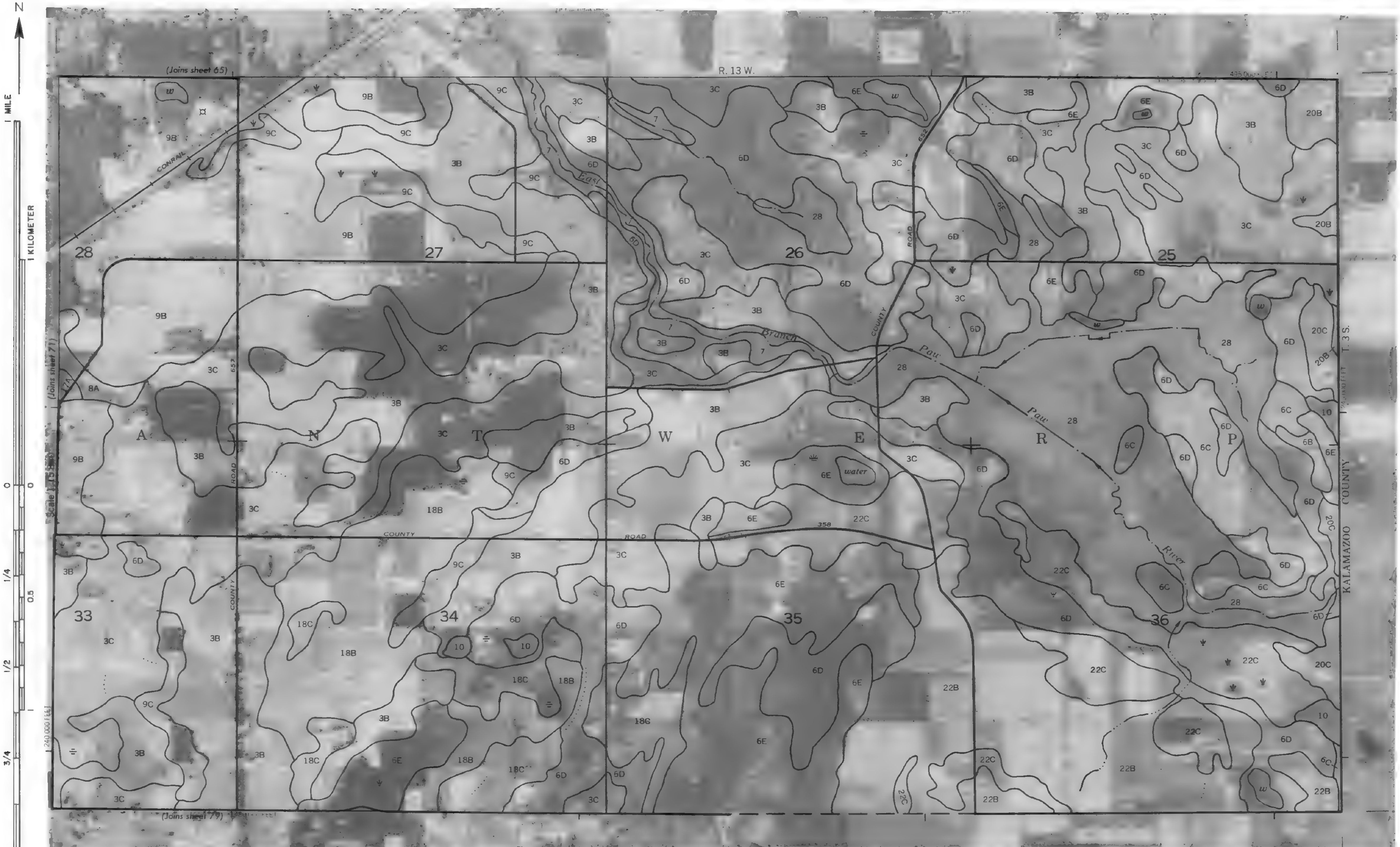



69
N
(Joins sheet 62)
(Joins sheet 68)
(Joins sheet 70)
(Joins sheet 76)
R. 15 W.
R. 14 W.
T. 3 S.
L A W R E N C E
P A W P A W
P A W
Christie
Lake
Perch
Lake
Eagle
Lake
Eagle
Lake
Drain
TERRITORIAL
ROAD
COUNTY
ROAD
PAW PAW
ROAD
COUNTY
25
26
29
30
31
32
35
36
245 000 FEET
240 000 FEET
1 MILE
1 KILOMETER
Scale 1:15 840


70
N
(Joins sheet 63)
(Joins sheet 69)
(Joins sheet 71)
(Joins sheet 77)
Threemile Lake
R. 14 W.
T. 3 S.
PAW PAW ROAD
COUNTY ROAD 358
Drain
Lawton Drain
Gates
Lake
Eagle
Scale 1:15 840
MILE
KILOMETER
445 000 FEET
240 000 FEET

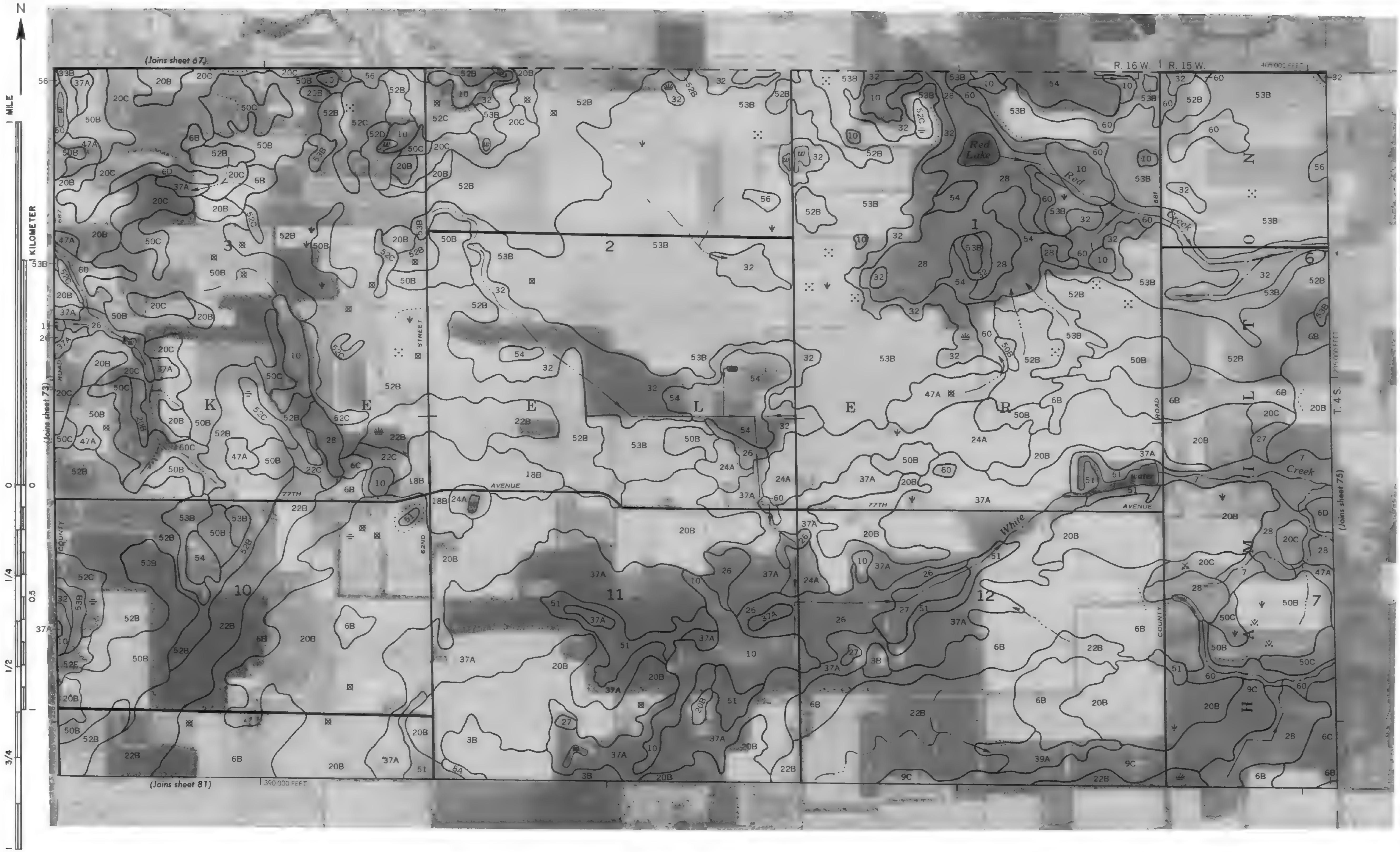

71
N
R. 14 W.
R. 13 W.
(Joins sheet 64)
(Joins sheet 70)
(Joins sheet 72)
(Joins sheet 78)
T. 3 S.
PAW PAW
ANTWERP
LAWTON
CEMETERY
CONRAIL
Lawton Drain
COUNTY ROAD 665
COUNTY ROAD 358
25
30
29
28
36
31
32
33
water
MILE
KILOMETER
Scale 1:15 840

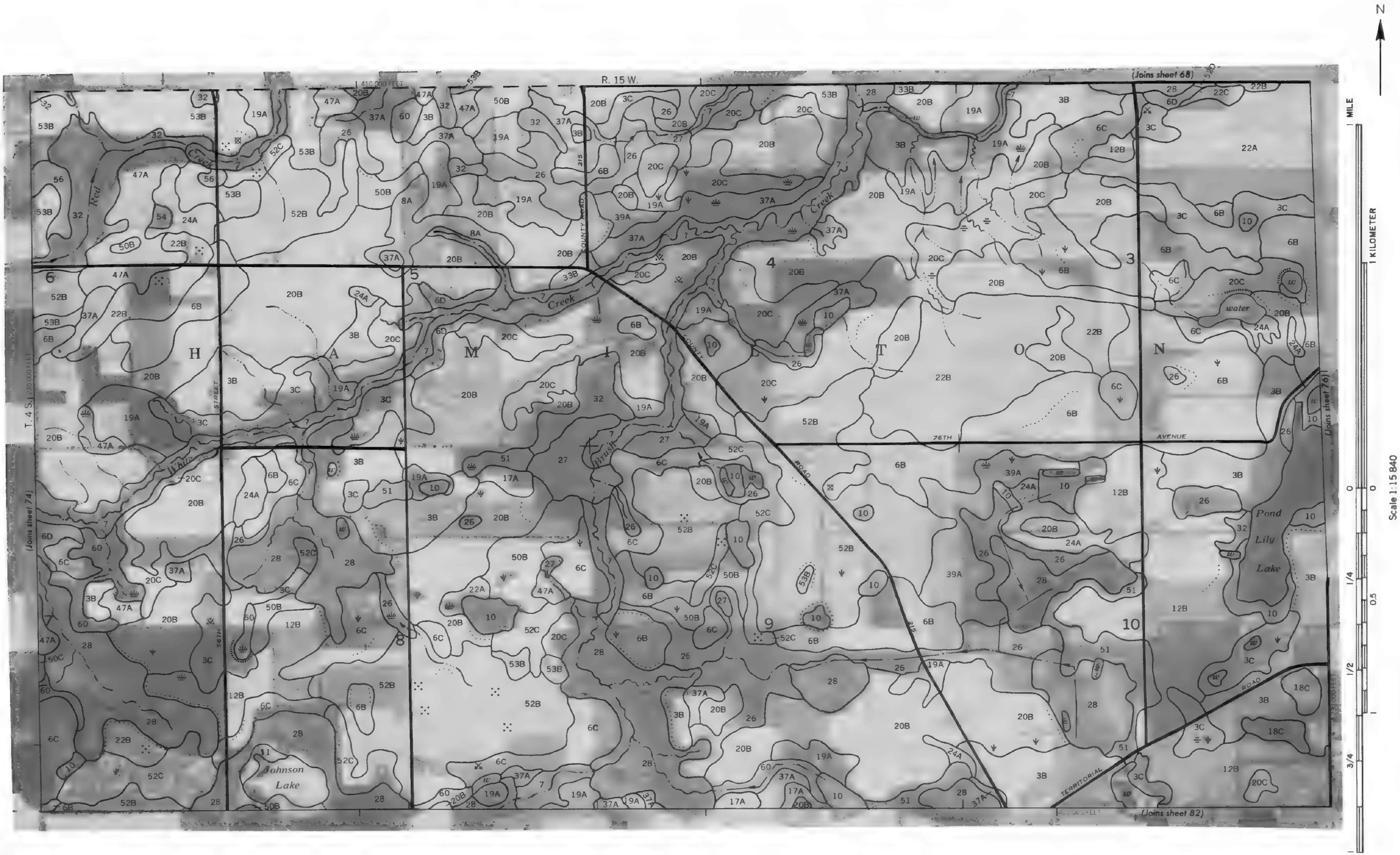
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 72

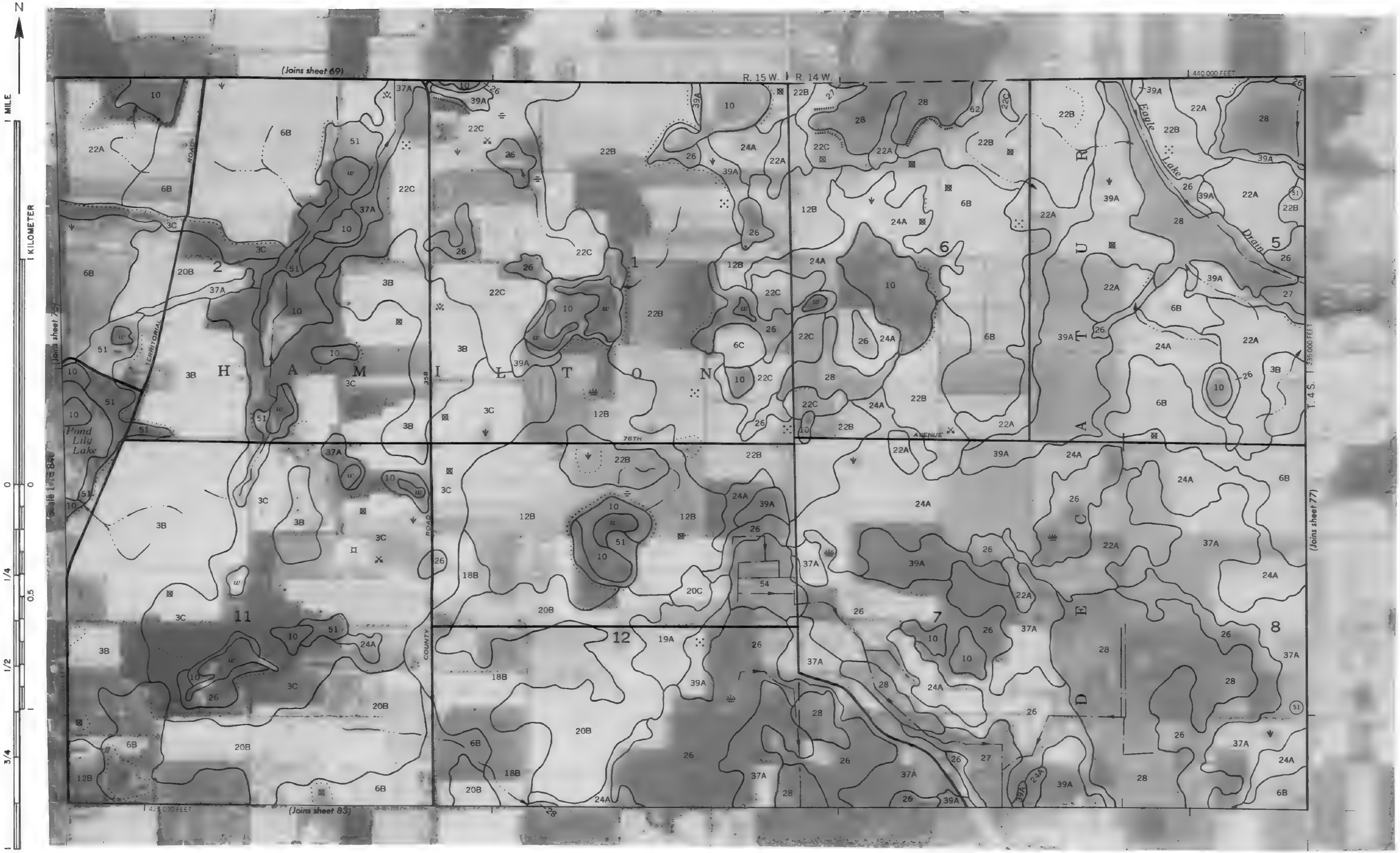



73
N
R. 16 W.
(Joins sheet 66)
(Joins sheet 74)
(Joins sheet 80)
370 000 FEET
235 000 FEET
230 000 FEET
T. 4 S.
BERRIEN COUNTY
COUNTY ROAD
76TH AVENUE
77TH AVENUE
Mill Creek
K E E L E R
6
5
4
7
8
9
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
1

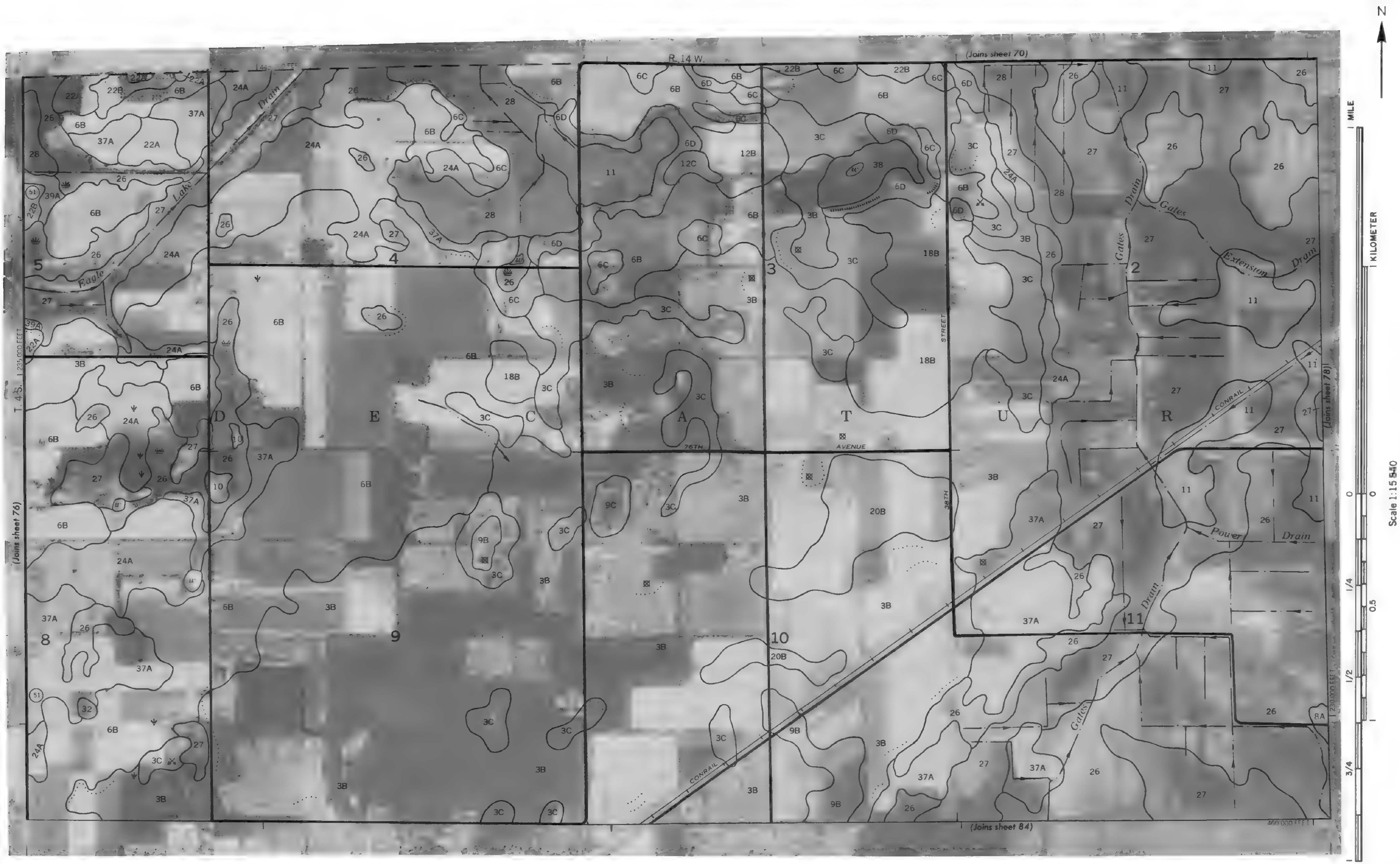
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 74




N
R. 15 W.
(Joins sheet 68)
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 82)
T. 4 S.
H A M I L T O N
Red Creek
Creek
White Creek
Brush Creek
COUNTY ROAD 215
STREET
56TH
76TH AVENUE
TERRITORIAL ROAD
water
Pond Lily Lake
Johnson Lake
MILE
KILOMETER
Scale 1:15 840

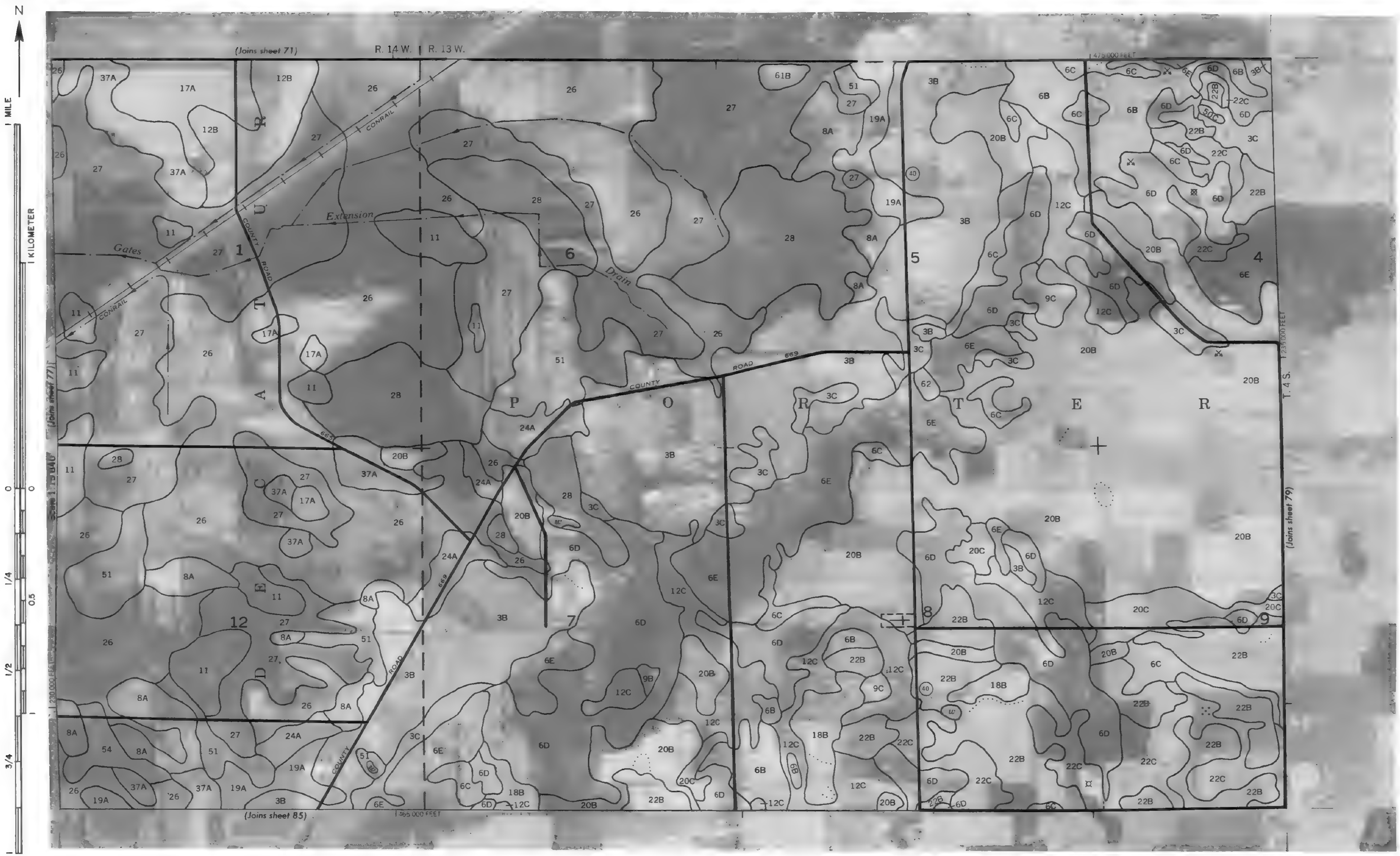

N
1 MILE
1 KILOMETER
(Joins sheet 69)
(Joins sheet 83)
(Joins sheet 77)
R. 15 W.
R. 14 W.
440 000 FEET
235 000 FEET
T. 4 S.
HAMILTON
DECATUR
Pond Lily Lake
Eagle Lake Drain
TERRITORIAL ROAD
COUNTY ROAD 358
76TH AVENUE

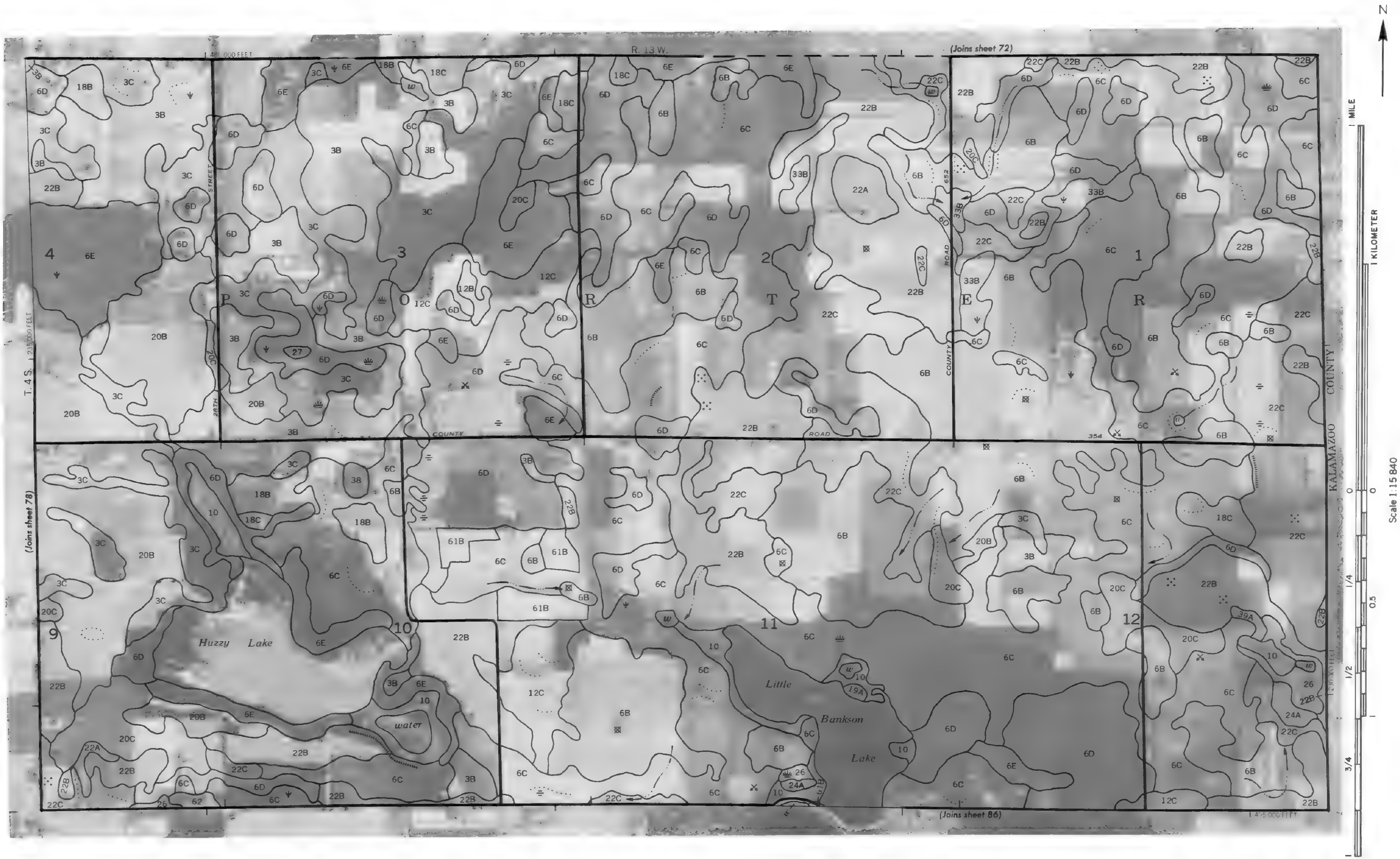
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 77

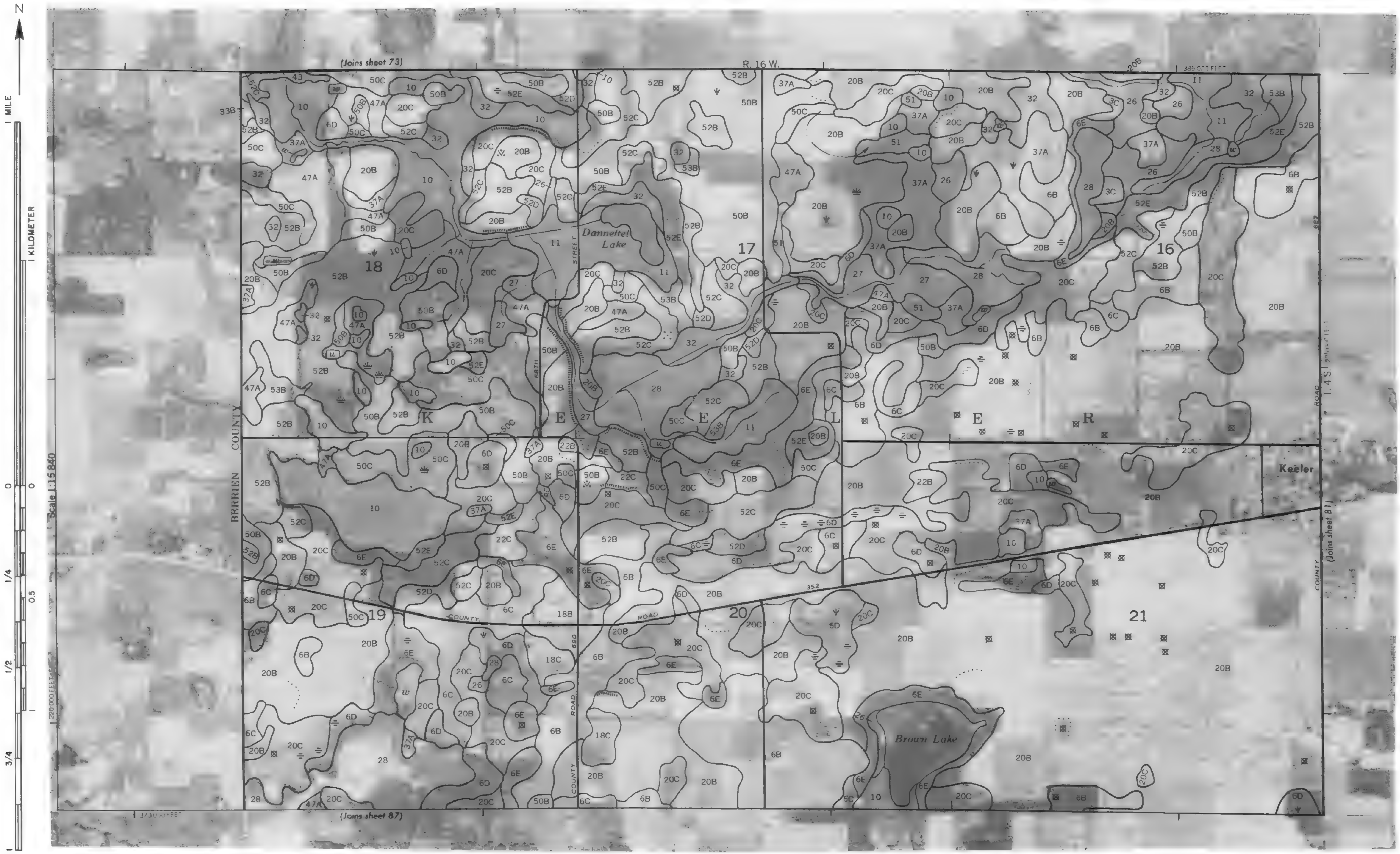


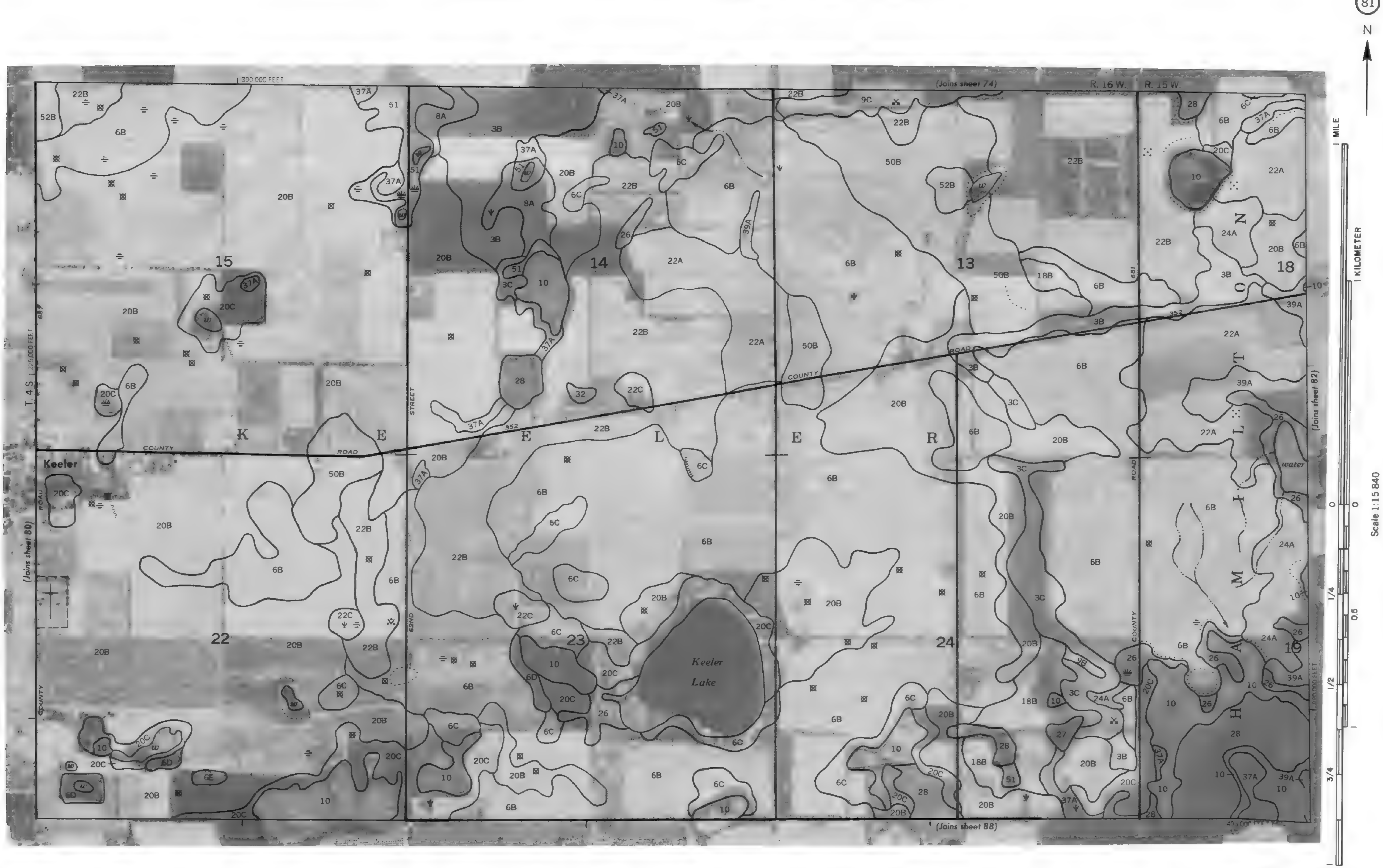
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 78

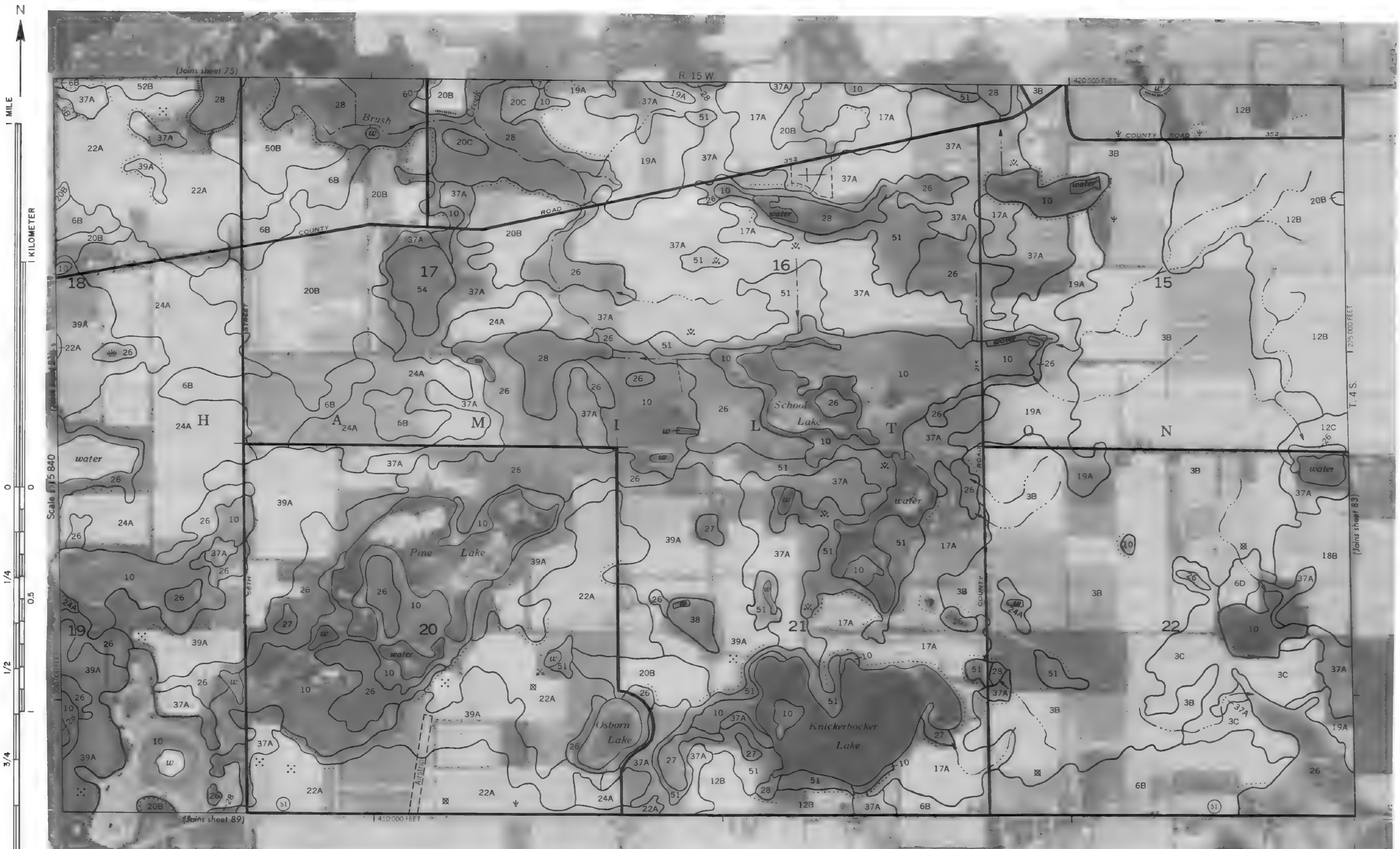
78

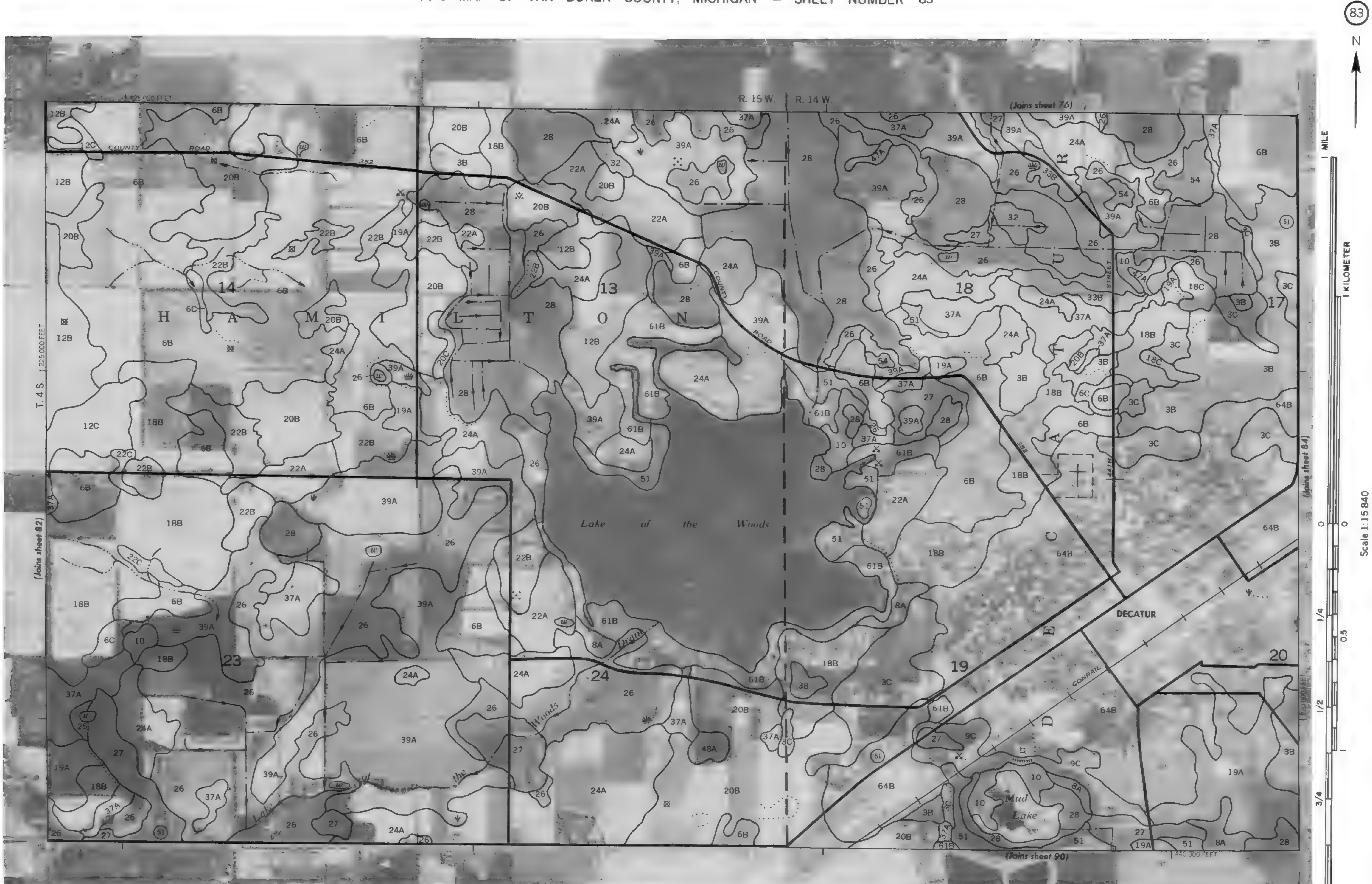



N
R. 13 W.
(Joins sheet 72)
(Joins sheet 78)
(Joins sheet 86)
T. 4 S.
480 000 FEET
215 000 FEET
PORTER
28TH STREET
COUNTY ROAD 652
COUNTY ROAD 354
KALAMAZOO COUNTY
Huzzy Lake
Little Bankson Lake
water
1
2
3
4
9
10
11
12
MILE
KILOMETER
Scale 1:15 840

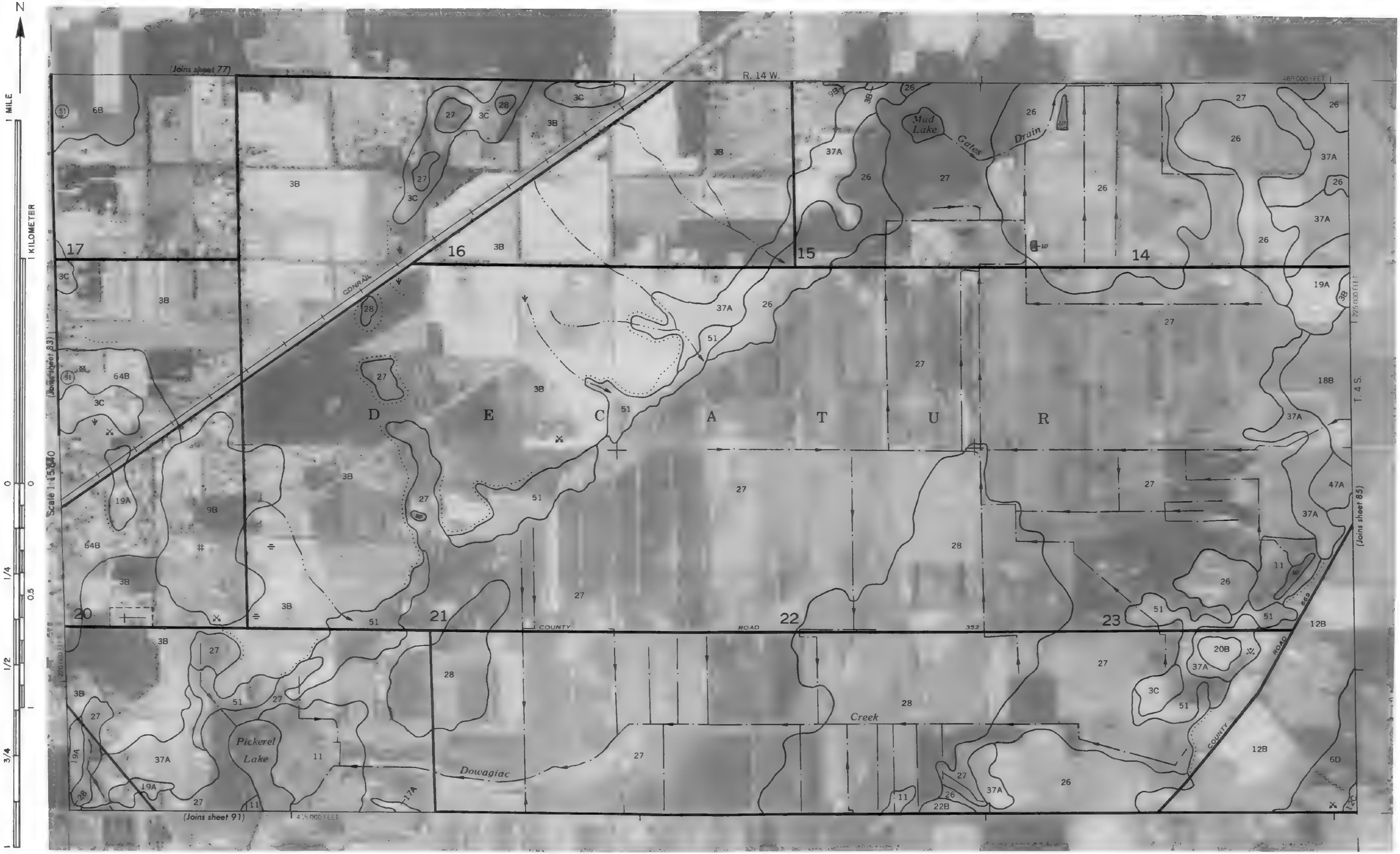

N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 73)
R. 16 W.
(Joins sheet 87)
(Joins sheet 81)
T. 4 S.
Danneffel Lake
Brown Lake
Keeler
K E E L E R
BERRIEN COUNTY
COUNTY ROAD
COUNTY ROAD 352
68TH STREET
COUNTY ROAD 690
18
17
16
19
20
21


81
N
(Joins sheet 74)
(Joins sheet 80)
(Joins sheet 82)
(Joins sheet 88)
R. 16 W.
R. 15 W.
T. 4 S.
390 000 FEET
Keeler
Keeler Lake
water
COUNTY ROAD 352
62ND STREET
COUNTY ROAD
ROAD
K E E L E R
H A M I L T O N
15
14
13
18
22
23
24
19
1 MILE
1 KILOMETER
Scale 1:15 840


N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 75)
R. 15 W.
420 000 FEET
Brush
COUNTY ROAD
School Lake
Pine Lake
Osborn Lake
Knickerbocker Lake
H A M I L T O N
T. 4 S.
225 000 FEET
(Joins sheet 83)
(Joins sheet 89)
410 000 FEET
Airstrip
15
16
17
18
19
20
21
22

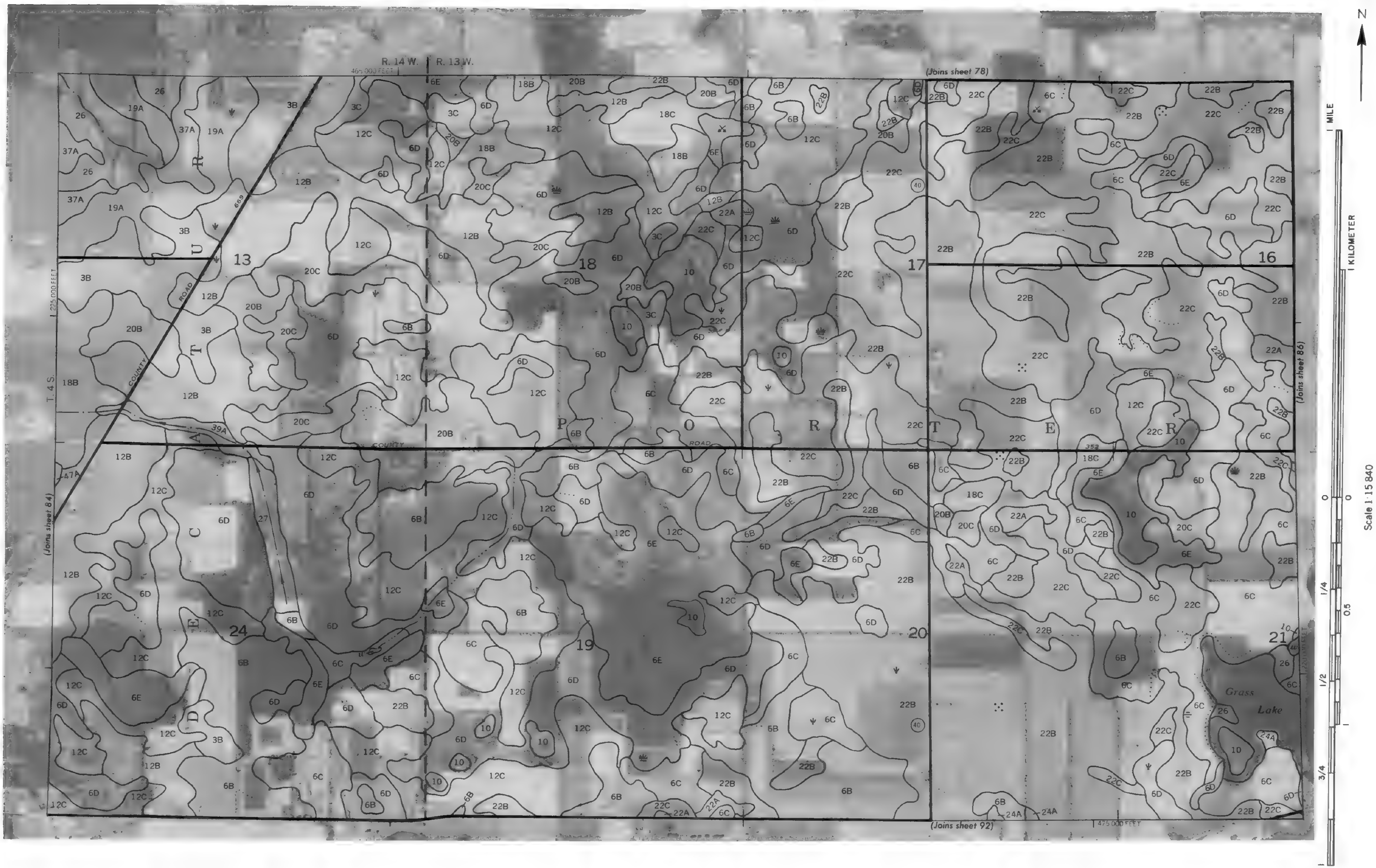

83
N
R. 15 W.
R. 14 W.
T. 4 S.
(Joins sheet 76)
(Joins sheet 82)
(Joins sheet 84)
(Joins sheet 90)
COUNTY ROAD 352
H A M I L T O N
D E C A T U R
DECATUR
Lake of the Woods
Mud Lake
CONRAIL
14
13
18
17
23
24
19
20
1 MILE
1 KILOMETER
Scale 1:15 840

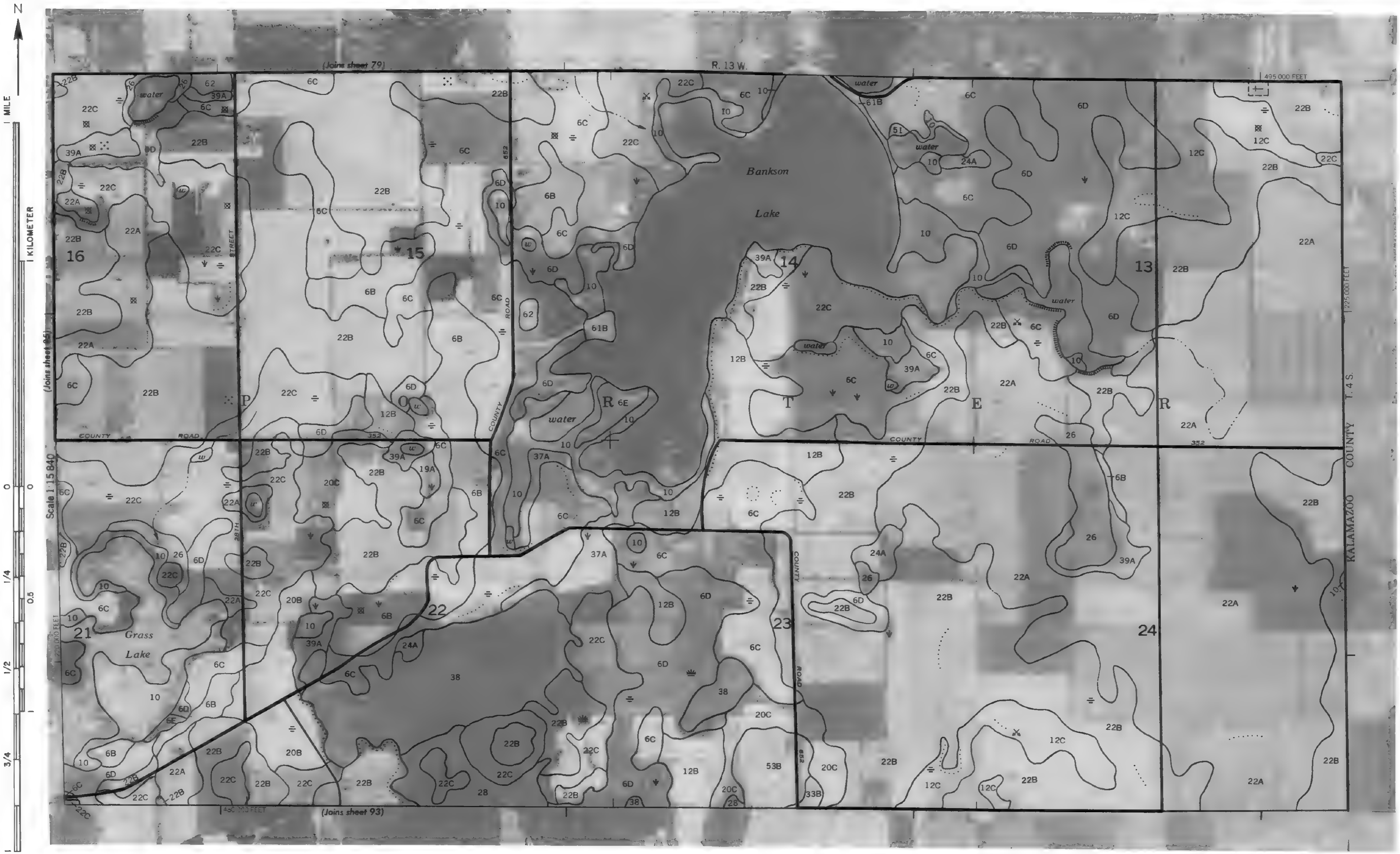
SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 84

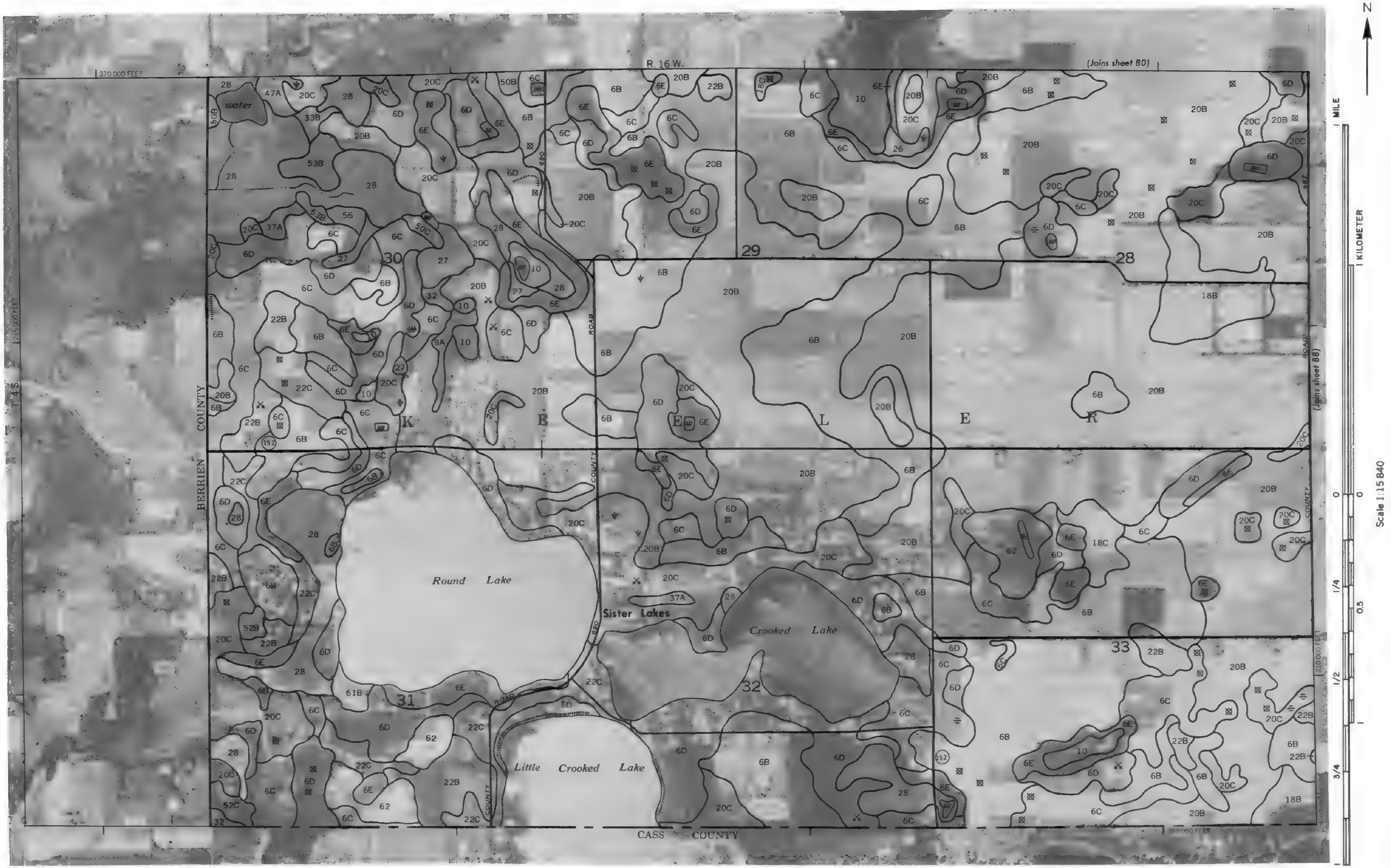


SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 85

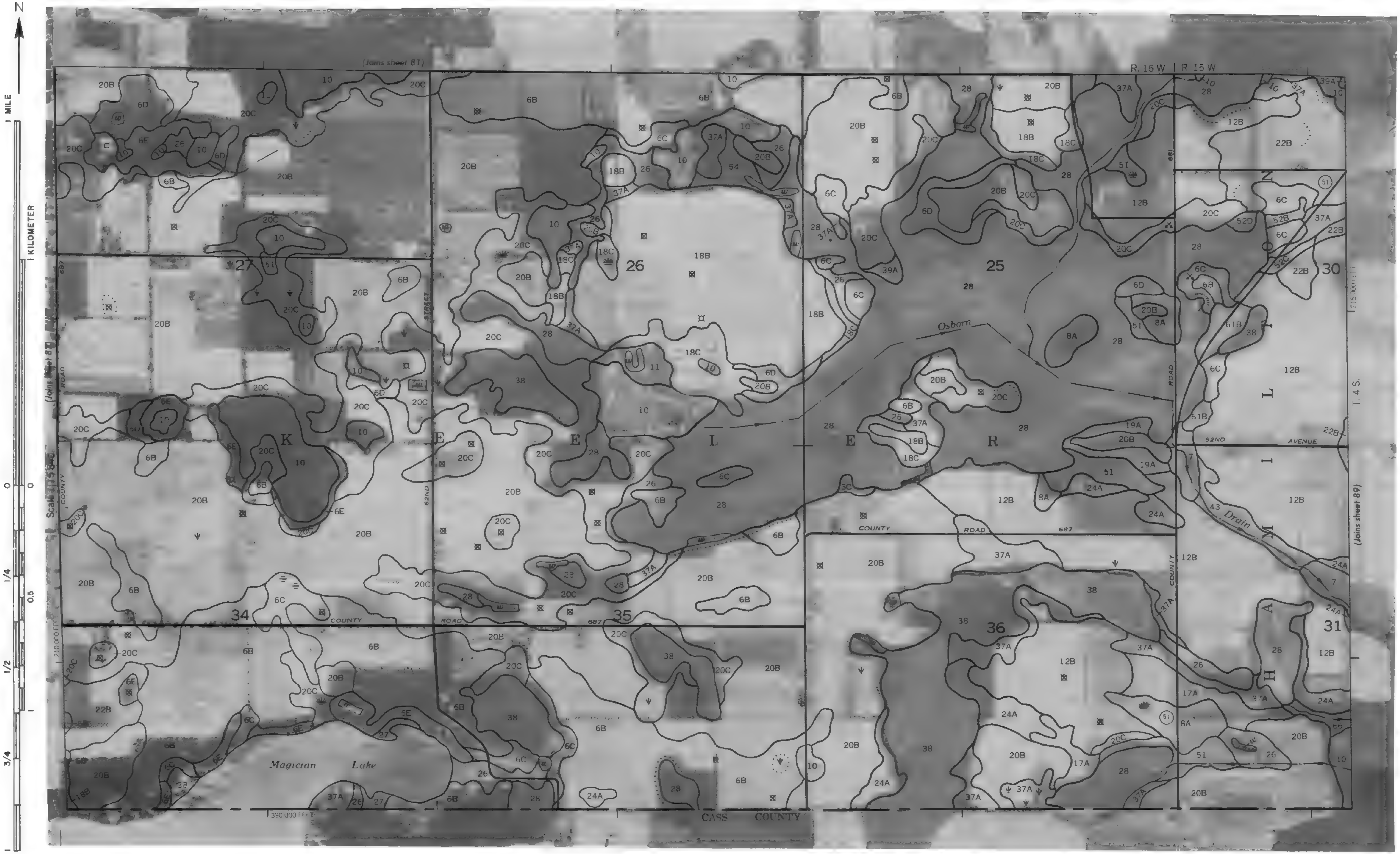
85

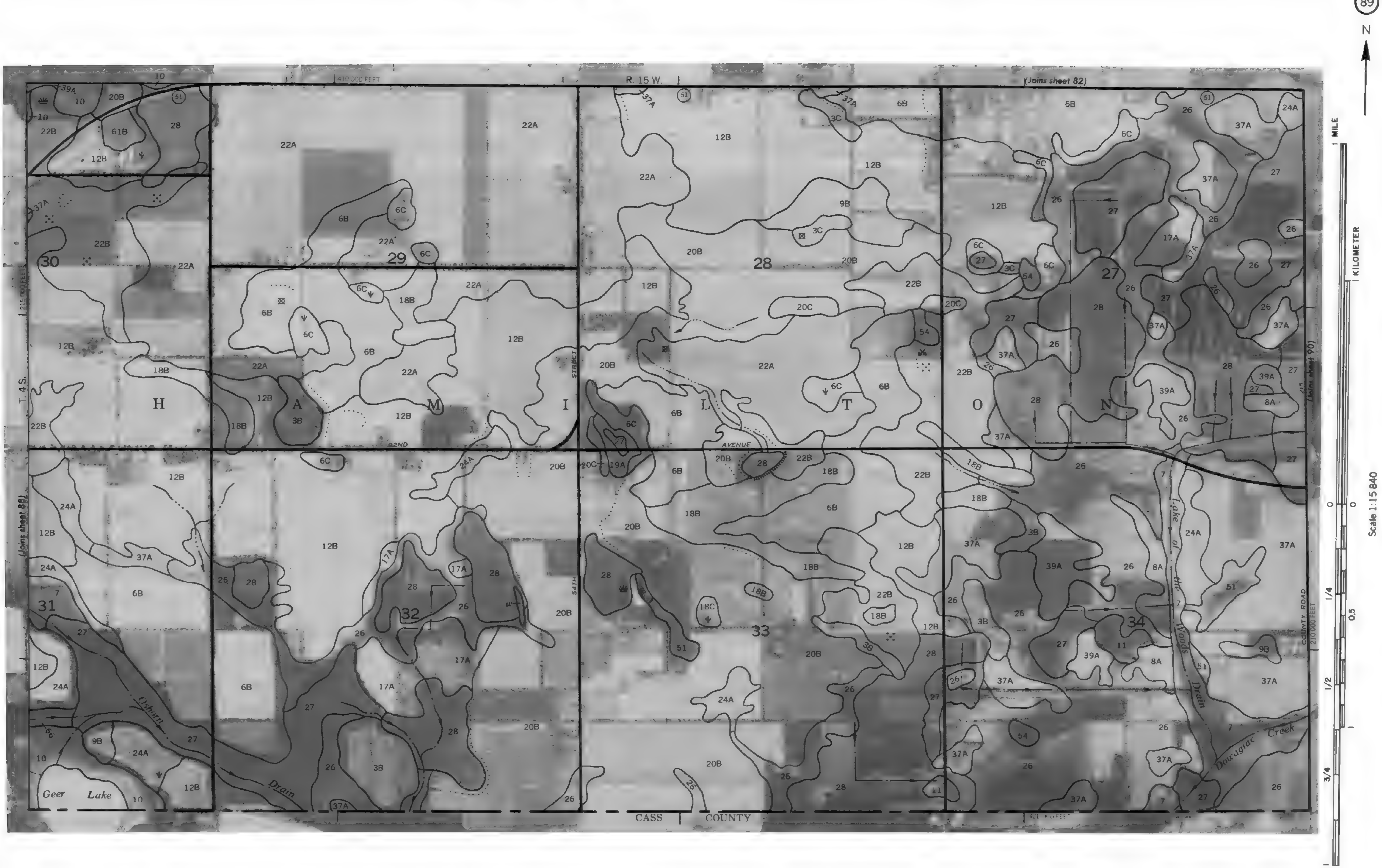



N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5
(Joins sheet 79)
(Joins sheet 93)
(Joins sheet 85)
R. 13 W.
T. 4 S.
495 000 FEET
225 000 FEET
460 000 FEET
KALAMAZOO COUNTY
Bankson Lake
Grass Lake
water
P O R T E R
COUNTY ROAD 352
COUNTY ROAD 652
28TH STREET
16
15
14
13
21
22
23
24


N
R. 16 W.
(Joins sheet 80)
(Joins sheet 88)
T. 4 S.
370 000 FEET
215 000 FEET
210 000 FEET
385 000 FEET
BERRIEN COUNTY
CASS COUNTY
COUNTY ROAD 690
COUNTY ROAD 687
water
Round Lake
Sister Lakes
Crooked Lake
Little Crooked Lake
K E E L E R
29
28
30
31
32
33
1 MILE
1 KILOMETER
Scale 1:15 840

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 88

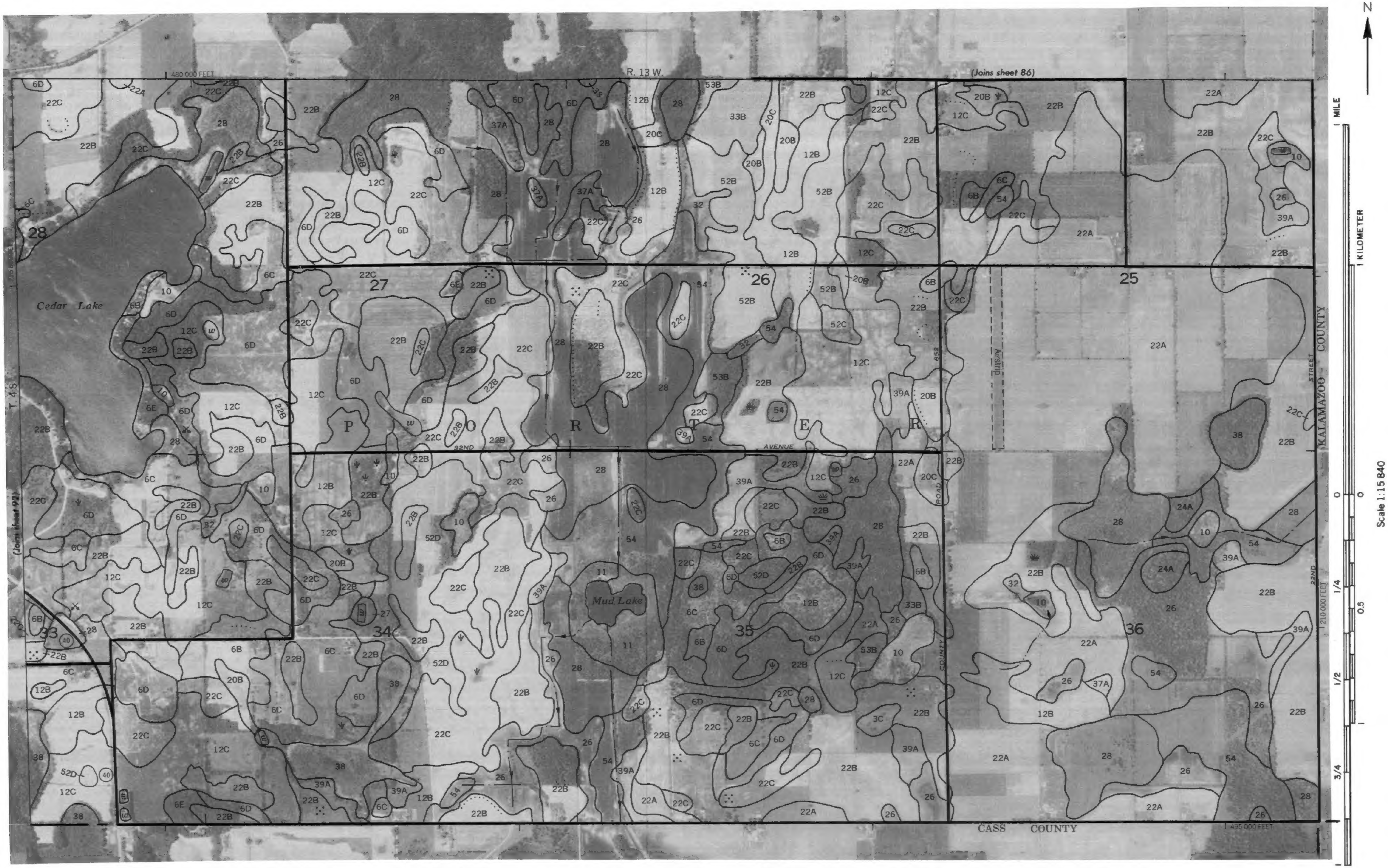



89
N
(Joins sheet 82)
(Joins sheet 88)
(Joins sheet 90)
R. 15 W.
T. 4 S.
HAMILTON
Geer Lake
Osborn Drain
Lake of the Woods Drain
Dowagiac Creek
CASS COUNTY
92ND AVENUE
54TH STREET
COUNTY ROAD
1 MILE
1 KILOMETER
Scale 1:15 840

SOIL MAP OF VAN BUREN COUNTY, MICHIGAN — SHEET NUMBER 90


91
N
R. 14 W.
(Joins sheet 84)
(Joins sheet 90)
(Joins sheet 92)
T. 4 S.
455 000 FEET
460 000 FEET
215 000 FEET
D E C A T U R
Dowagiac Creek
COUNTY ROAD
92ND AVENUE
STREET
CASS COUNTY
29
28
27
26
32
33
34
35
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
Scale 1:15 840
(Joins sheet 85)
R. 14 W.
R. 13 W.
475 000 FEET
(Joins sheet 91)
(Joins sheet 93)
T. 4 S.
92ND AVENUE
Airstrip
Cedar Lake
Little Cedar Lake
Gravel Lake
Swift Lake
CASS COUNTY
465 000 FEET
25
30
29
28
36
31
32
33



(Joins sheet 86)
(Joins sheet 92)
480 000 FEET
R. 13 W.
T. 4 S.
Cedar Lake
Mud Lake
P O R T E R
27
26
25
28
34
35
36
33
92ND
AVENUE
Airstrip
COUNTY ROAD 652
KALAMAZOO COUNTY
22ND STREET
CASS COUNTY
210 000 FEET
435 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:15 840
0
1/4
1/2
3/4
0.5